THE IRON TRADE REVIEW

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Hopeful at Old Year End

General Movement to Get Away From Lowest Quotations on Finished Materials, But Concessions Still Made on Some Products

Cheerful sentiment dominates at the close of one of the most unsatisfactory years in the history of the iron trade. The lull in buying and the decreased activity of plants, which always characterize the holiday season except in years of great prosperity, are features of the present situation, but the feeling that early in the new year there will be a decided improvement has been growing stronger and an effort is being made to obtain higher prices on finished products. On plates, shapes and bars, leading independent companies have announced that after today they will not accept specifications for any delivery at 1.05c, Pittsburgh, which has been the prevailing price for prompt delivery, but will insist upon a minimum of 1.10c for either prompt or first quarter. This action has been concurred in by the Carnegie Steel Co., and fair tonnage has been specified in order to get the lower price.

Pig Iron

In spite of the lull in pig iron buying, recent sales make a fair tonnage. One Cleveland firm has disposed of 30,000 tons during the past 10 days and scattering lots making a considerable total have been sold throughout the country. Statistics showing sales during 1914 by some firms make a better showing for the 11 months as compared with the corresponding period in 1913 than had been expected.

Structural Material

Keen competition in structural material continues. The McClintic-Marshall Co. has taken a number of tonnages of fair size, including 3,500 tons for a new power house for the Corrigan, McKinney & Co. blast furnace plant at Cleveland, 1,500 tons for a waterworks pumping station in Cleveland, and 1,500 to 2,000 tons for a municipal cotton warehouse in New Orleans. The Jones & Laughlin Steel Co. has taken 1,000 tons for alterations to the cooling plant at the Union Stock Yards, Pittsburgh.

Machinery

Leading machine tool manufacturers in Cincinnati and other centers are extremely busy filling orders for shipment to England. One Cincinnati company last week shipped two carloads of lathes to England and has received an additional order for two carloads of lathes from Italy. A large inquiry still is pending from Russia for lathes for quick delivery.

Tin Plate

In tin plate, buying by the largest consumers is nearly ended. It is understood that very low prices have been made to some of the largest interests. Cast iron pipe is another product on which very low prices have been developed, as shown in the award of 7,500 tons by the city of Chicago, divided among three companies, at prices much below prevailing quotations.

Railroad Buying

The New York Central is expected to inquire today for 40,000 tons of rails in addition to its recent inquiry for 20,000 tons and other rail inquiries are expected shortly. The New York Central is also in the market for a considerable quantity of bolts, nuts, bars and other products. General railroad buying is not, however, developing rapidly.

Scrap

Dealers in old material are holding firmly to their accumulations and apparently are confident of being able to obtain higher prices. The tone of the market is better in some quarters, but sales are very light.

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Not Playing Favorites

MORE vigorous action in regard to foreign commerce is advocated in a rather remarkable editorial by the *Iron and Coal Trades Review*, of London, in its issue of Dec. 11. The *Review* asserts that neutral trading countries look at the question of contraband from an entirely selfish point of view. It says that Swedish ore is now being sent to Rotterdam, clearly destined for German consumption. Of course, no one will deny that in considering the question of contraband there is a selfish element, but at the same time we believe there is an overwhelming sentiment in this country in opposition to doing anything that could with good reason be condemned by any of the nations now at war. As was stated in THE IRON TRADE REVIEW last week, an inquiry for iron ore has been received from Rotterdam, but it has not been received seriously and no one expects that any shipments of ore will be made from the United States to that foreign port.

After declaring that many professions of neutrality are nonsense, the *Review* quotes with approval a paragraph from a recent address by Gibson Bowles, who says:

"If we resumed and exercised the powers of our navy, the German prices for sea-borne raw material would certainly in time rise to 12 times as much. That was achieved in the Napoleonic war. To escape that ruin now began to be Germany's chief object. How was it to be attained? Only by employing, if possible, neutral vessels to carry on the trade which German vessels were unable to continue. It was our duty and business to prevent them from carrying on that trade. It was because by certain instruments—by the Declaration of London, 1909, the 14 Hague conventions, 1907, and the Declaration of Paris, 1856—that large portions of the right and power to do this had been lightly and inconsiderately surrendered, that it had now become essential for final success in this war to demand the resumption of those surrendered powers."

The *Review*, commenting on Mr. Bowles' speech, says that the British government has acted with studied moderation and cites its attitude in placing cotton on the free list, which it says was "a very questionable step", and its willingness to permit the export of ferro-manganese from England and manganese ore from India under the guarantee that no part of such shipments would be subsequently re-exported in such a manner as ultimately to reach the enemy. The *Review* says that this attitude of the British government is "hardly reciprocated in the United States". It does not, however, state any facts which will convince an unprejudiced reader of the truth of the statement. It says that the American press has hinted that the British action regarding copper and ferro-manganese is designed to cripple American trade to the eventual advantage of Great Britain. We have seen no statement of this kind, and if it has been published, it does not express the general feeling in this country. In fact, the *Review* admits that no one who knows anything about the metal trade could honestly hold these views, but it says there seems to be cause for supposing that the agitation is in some measure the result of the work of German sympathizers in the United States. "The plain facts are," says the *Review*, "that the war of today is just as much an industrial struggle as a struggle with the rifle. Industrial paralysis will be just as effective as military paralysis in ending the fight. The governments of the neutral countries know this quite well, and should be prepared to give the necessary guarantees as to the destination of cargoes. If the Germans were supreme on the water, they certainly would demand such guarantees. Kid glove diplomacy is out of place in matters so vitally affecting the continuance of the expenditure of so much life and treasure."

We believe that the American government is acting in a reasonable spirit and that manufacturers are in harmony with the policy of preserving absolute neutrality. The action of Mr. Schwab in cancelling orders for $15,000,000 worth of material is positive proof of the sincerity of the government and of at least one of the most important steel manufacturers in the country. In that particular case, England suffered, but if it had been a case involving

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shipments to Germany, the attitude of the government and of Mr. Schwab would have been precisely the same. The United States is not playing favorites.

To Avoid Confusion

CONFLICTS in the law, creating litigation and confusion, would be greatly reduced if a legislative reference bureau, or a like agency, were attached to the library of congress. Moreover, it ought to checkmate a flood of ridiculous bills, prevent duplications and avoid loose language in framing the measures. An exact standard of legislative science seems impossible this side of Utopia, but the bureau would nevertheless encourage clearly considered legislation before it would be laid before congress.

These facts have caused to be received with pleasure the announcement that the library of congress will shortly undertake a service similar to that of the legislative reference bureau established by most of the states.

Bills and resolutions of the most absurd nature are thrown into the "hopper" under the present system, many of them never to be heard of afterward, and never designed for enactment. They cause, however, a sufficient flurry to make business in this country apprehensive. And foreigners, who are expected to invest their securities in the United States, not understanding the modus operandi, are often startled to such an extent that they abandon their plans and invest elsewhere.

Congress, in 1906, authorized an appropriation to enable the librarian "to prepare such indexes, digests and compilations of laws as may be required for congress". It is understood that the library now hopes to go further, employing a corps of experts in law, competent to analyze, summarize and compare; an auxiliary corps of translators and indexers and assistants familiar with the bibliography of the law. Study would be given to existing laws and other material in relation to proposed legislation and digests and comprehensive statements would be presented.

The immediate adoption of a method which would effect such a system cannot be too strongly urged.

No Extra Session

THE passage of a bill to amend the Sherman anti-trust law so as to promote combinations to build up export trade is greatly to be desired, but, important as the enactment of this measure is, we do not believe that it ought to be allowed to interfere with the members of congress remaining at home from March 4 until the opening of the regular session in December, 1915. If congress does nothing but pass the appropriation bills during the short session, the country will feel relieved and be thankful. An extra session of congress would drag through the summer, would be a menace to business and would probably result in the enactment of some legislation which would be decidedly harmful. The business world needs relief from agitation more than anything else.

Wages for Dirty Work

AT THE present time, with several millions idle in the United States, it is not difficult to find men to do almost any kind of work, but far-seeing employers are not unmindful that with the return of prosperity and with a labor shortage in Europe probable as one result of the war, there is very likely to be a serious labor shortage in this country. Hence the question arises—How will men be obtained to do disagreeable work? In a recent paper, read before the Cleveland Engineering Society, Thomas D. West called attention to the strong dislike of Americans for anything that begrimes and callouses. Mr. West believes that to meet this situation it will be necessary to have a very much higher wage rate and shorter hours for common labor, while those who prefer clean, easy and comfortable work with few responsibilities ought not to have their compensation increased. This is a suggestion well worthy of consideration. The dirty work must be done and Americans may find it increasingly difficult to depend on immigrants to do it.

Prices Present and Past

Quotations on leading products today, average for last month, average for three months ago and average for December 1913. Prices are those ruling in the largest percentage of sales at the dates named.

	Today's prices.	Average for Nov., 1914.	Average for Sept., 1914.	Average for Dec., 1913.
Bessemer pig iron, Pittsburgh..	$14.70	$14.70	$14.90	$15.90
Basic pig iron, Pittsburgh.....	13.45	13.45	13.90	13.71
No. 2 Fdy. pig iron, Pittsburgh	13.70	13.70	13.80	14.36
Northern No. 2 Fdy., Chgo....	13.00	13.00	13.50	14.50
Lake Superior Charcoal, Chgo..	15.75	15.75	15.75	15.50
Malleable, Bessemer, Chicago...	13.00	13.00	13.50	14.50
Southern No. 2, Birmingham...	9.50	10.00	10.00	10.75
Southern Ohio No. 2, Ironton..	12.75	13.00	13.00	13.50
Basic, eastern Pa.....	13.50	13.50	14.00	14.25
No. 2X Virginia furnace.....	12.50	12.50	12.50	12.75
No. 2X Foundry, Philadelphia..	14.25	14.25	14.75	15.00
Ferro mang., Balti.....	68.00	68.00	80.00	47.00
Billets, Pbgh.	19.00	19.00	21.00	20.00
Sheet bars, Pbgh.....	19.50	19.62	22.00	21.00
Steel bars, Chicago.....	1.19	1.25	1.38	1.38
Steel bars, Pittsburgh.....	1.05	1.10	1.20	1.31
Iron bars, Philadelphia.....	1.12	1.15	1.17	1.27
Iron bars, Cleveland, local del'y.	1.15	1.20	1.20	1.30
Iron bars, Chgo. mill.....	.95	.975	1.07	1.15

	Today's prices.	Average for Nov., 1914.	Average for Sept., 1914.	Average for Dec., 1913.
Beams, Chicago	$1.19	$1.25	$1.38	$1.38
Beams, Pittsburgh	1.05	1.11	1.20	1.25
Beams, Philadelphia	1.20	1.25	1.30	1.35
Tank plates, Pittsburgh.....	1.05	1.09	1.18	1.18
Tank plates, Chicago.....	1.19	1.25	1.38	1.33
Tank plates, Philadelphia.....	1.20	1.25	1.30	1.40
Sheets, blk., No. 28, Pittsburgh	1.80	1.89	1.95	1.88
Sheets, blue an., No. 10, Pbgh.	1.35	1.39	1.40	1.40
Sheets, galv., No. 28, Pbgh....	2.80	2.86	2.95	2.87
Wire nails, Pittsburgh.....	1.50	1.59	1.55	1.55
Connellsville fur. coke contr....	1.70	1.65	1.75	1.81
Connellsville fdy. coke, contr...	2.25	2.25	2.35	2.54
Heavy melting steel, Pbgh.....	10.50	10.06	11.44	11.00
Heavy melting steel, east'n Pa.	9.50	9.50	10.50	10.00
Heavy melting steel, Chgo.....	8.00	8.25	9.37	9.00
No. 1 wrought eastern Pa.....	11.50	11.00	12.50	13.00
No. 1 wrought, Chgo.....	8.00	7.50	8.31	8.50
Rerolling rails, Chgo.....	9.50	9.50	10.87	11.50
Car wheels, Chgo.....	10.00	10.00	10.75	12.25

(For Additional Prices See Page 1241.)

Holiday Lull in Pig Iron Buying

Usual Lack of Interest for This Season of the Year is Manifested, But Fair Tonnages Booked by Some Sellers

Cleveland, Dec. 29.—One Cleveland firm during the past ten days has sold 30,000 tons of pig iron for delivery from several furnaces and companies having smaller production also report a fair amount of business. As usual, however, at inventory time, the market is quiet. The Cleveland Furnace Co. has advanced its price for No. 2 foundry iron to $13.50, delivered in Cleveland, an advance of 25 cents, but no sales have been reported at the new figure. The company's order books are in good condition and it is not anxious to take business at present.

Machine Company Wants Foundry

Pittsburgh, Dec. 29.—Pig iron dealers in western Pennsylvania and the valleys are experiencing the usual lull that features the market at the end of the year. Several tentative inquiries are pending, but indications are that none of them will be closed until after Jan. 1. The Westinghouse Machine Co. is in the market for first half requirements for its foundry at Trafford, estimated at about 3,500 tons, and several other melters of foundry grades are figuring needs. An inquiry for 6,000 tons of bessemer iron, mentioned by The Iron Trade Review last week, appears to have been dropped. Prices are unchanged in position, with bessemer selling at $13.75, basic $12.50 and foundry and malleable from $13 to $13.50, at valley furnaces.

Good Volume to Shipments

Buffalo, Dec. 29.—Furnaces of the Buffalo district report a week of light sales and but little inquiry, but this is an expected situation over the holiday period. Prices remain unchanged and the producers manifest no disposition to send out salesmen until after the turn of the year and inventories have been taken. None of the interests are seeking to book business at this time. A number of the melters have closed down pending the taking of inventories.

Shipments, on the other hand, are going forward in considerable volume, as they have been doing for the past few weeks.

More Pipe Iron Bought

Philadelphia, Dec. 28.—The past week has been an extremely quiet one in the eastern Pennsylvania pig iron market. A Hainesport, N. J., melter closed for 2,000 tons of No. 3 foundry and No. 2 plain, distributed about equally between southern and eastern Pennsylvania furnaces, and the United States Cast Iron Pipe & Foundry Co. bought some northern iron to fill in with the recent purchases of southern iron. With these exceptions, the business of the week consisted of small lots which formed only a small total. There is somewhat better feeling among pig iron sellers, due partly to the recent large sales and partly to the better sentiment which prevails generally. There is an inclination to expect better things after the first of the year, but this has not been reflected by any tendency to ask higher prices on future deliveries. Standard low phosphorus iron is somewhat higher and now is quotable at $19.50 to $20.50, Philadelphia, on which basis some small lots were sold last week. Small sales of Virginia iron in no case, as far as known, brought higher than $12.50 at furnace, for No. 2X; no sales are heard of at below this level. A few first quarter contracts for foundry iron were consummated during the week, but the total was not of moment as most of the first quarter contracts previously had been disposed of.

Inquiry Low

Cincinnati, Dec. 28.—The pig iron market is very quiet and no changes are looked for by the trade until after the holiday season. The most favorable

(For complete price list see page 1241.)

feature is the fact that shipments are going forward as well as could be expected and that the melt is a little heavier at the present time than was the case six months ago. The inquiry is very low and the only orders booked at present are occasional small lots through solicitation by salesmen.

Prices are unchanged, southern No. 2 foundry being quoted at from $9.50 to $10, Birmingham basis, and southern Ohio No. 2 foundry at $12.75, Ironton basis.

Very Little Pending

St. Louis, Dec. 28.—There is nothing bright in the outlook for an immediate improvement in the pig iron situation, and dealers are not looking for better conditions until after stocktaking. Inquiries in the local market are 600 tons of Lake Superior charcoal iron, and 500 tons of coke wheel iron. A sale was made Thursday of 1,000 tons of northern iron. Southern No. 2 is quotable here at $9.50 to $10. Northern prices are unchanged from last week.

Shipments Hastened.

New York, Dec. 29.—The week just closed has witnessed very little actual business, due to the holidays, and no developments of importance are expected until after the turn of the year. Current business consists largely of small tonnages for spot shipment. Some further contracting has been consummated, but this was not large in the aggregate, as most first quarter business and some first half business already had been cleaned up. A significant feature is that consumers no longer are requesting that shipments on contracts be deferred. Instead, numerous requests have been received by the sellers to hasten such deliveries. This tendency has become more marked the past couple of days. There is a rather cheerful feeling in regard to the future. Prices are unchanged.

Prices Are Steady.

Chicago, Dec. 30.—Chicago sellers of pig iron find the week between holidays marked by the usual lack of interest and comparatively little is being done. Prices are unaffected and northern No. 2 foundry and malleable are steady at $13, Chicago furnace.

Figures showing sales during 1914 indicate the total tonnage disposed of for 11 months of this year compared more favorably with the corresponding period in 1913 than had been expected. The sudden shortening of inquiry and selling is indicated by the figures of one concern which finds that only 5 per cent of its December sales were made during the past week.

Southern iron is in much the same condition as northern and the holiday lay-up is apparent. Prices remain much as they have been with $10, Birmingham, held strongly by most makers and some iron is available at a shade under this price.

May Blow in More Stacks.

Birmingham, Dec. 28.—The pig iron market of the Birmingham district is passing through the holidays without incident. No sales of any consequence are reported and none are expected now by Birmingham makers until first quarter spot buying may develop next month.

It is probable that one or two extra furnaces will go into blast in January following the heavy sales of southern pig during the past two months for first half delivery. Quotations on No. 2 foundry, Birmingham, remain at $10, with business, however, still being done at a slightly lower price.

High Rates

Of Ocean Carriers Still Prevents Billet Shipments

Philadelphia, Dec. 28.—The billet market in eastern Pennsylvania is very quiet and no inquiries of any importance came out last week. Prices are nominal and unchanged. Inquiries for good tonnages continue to come from abroad, especially from Italy, but none of these are being converted into orders, due to the high ocean freight rates. While the prospective foreign buyers need the material, the disparity between the prices they get for their finished materials and the prices they would be forced to pay for the billets, due to the freight rates, effectually prevents closing. Certain makers have withdrawn from the market temporarily due to the low price level which has been established in this market by transactions made recently.

Improvement Expected

Pittsburgh, Dec. 29.—With sheet and tin plate mills booking attractive tonnages, demand for sheet bars probably will show marked improvement after Jan. 1. The Carnegie Steel Co. is refusing to sell material at less than maximum prices, but prevailing minimum quotations continue to be offered at some centers. Numerous inquiries for wire rods for shipment to the allies are pending, but not many actual orders have been placed in the Greater Pittsburgh district recently.

(*For complete price list see page* 1244.)

Ferro Buying

Is Done With Considerable Difficulty—Demand Limited

New York, Dec. 29.—The ferro-manganese market is very quiet, due partly to the fact that consumers are pretty well supplied, and also to the difficulty in arranging for shipments from abroad. Importers report that they are accepting orders for future delivery that are accompanied by stipulations that the material or the steel into which it is manufactured will not be re-exported; such orders are accepted subject to whatever arrangements can be made in England in regard to shipment. As the importers cannot give any assurances as to shipments, it naturally is difficult to make sales surrounded by these conditions. Importers say they have a plentiful supply of ferro-manganese on hand for spot shipment, but the demand for spot is very limited. The price on English material continues $68 at seaboard. Nothing is heard in regard to any activity on the part of the United States Steel Corporation as a seller of ferro-manganese.

Figure Ferro Needs

Pittsburgh, Dec. 29.—Scattering inquiries have come out for ferro-manganese for prompt and future shipment, but no actual orders have been placed with dealers here, so far as can be ascertained. While England has made more rigid its embargo against this alloy, yet dealers express the belief that no great difficulty will be experienced in obtaining material for domestic consumers. Other alloys are quiet.

Tin Plate Buying Ends

Pittsburgh, Dec. 29.—The buying season for tin plate practically is at an end. More prominent consumers are under cover for 1915, and all of them have made reservations. As previously reported by THE IRON TRADE REVIEW, attractive tonnages have been obtained at $1 and $2 a ton below the price at which books for the first half of 1915 were opened, Dec. 3, $3.20 per base size box. Specifications have been coming out at a satisfactory rate, and mills probably will operate at about normal capacities after the holidays.

The first annual banquet of the National Scrap Iron and Steel Association will take place at the Hotel La Salle, in Chicago, Tuesday, Jan. 19. Representatives of the branches at Detroit, Cleveland, Youngstown and Pittsburgh are expected to be present.

Higher Prices for Bars

Are Asked by Some Makers, But Evidences of Weakness Have Not Entirely Disappeared

Philadelphia, Dec. 28.—During the week, some sellers have endeavored, by asking 5c per 100 pounds more on plates and shapes, to bring back the differential which at one time prevailed between the price of these finished products and the price of bars. While these efforts failed, as far as raising the price of plates and shapes is concerned, it is probable that they served to weaken the situation in bars. While 1.10c, Pittsburgh, or 1.25c, Philadelphia, is the price on first quarter, and 1.15c, Pittsburgh, or 1.30c, Philadelphia, on second quarter, lower prices are heard on spot. It is said spot tonnages may be had at material concessions. At least one small tonnage went last week at 1.12c, Philadelphia, which figures out to less than 1c, Pittsburgh; this, however, was an exceptional case and is not representative of the market, which can be quoted at 1.05c, Pittsburgh, or 1.20c, Philadelphia.

Many are Covered

Buffalo, Dec. 29.—Mills and agencies of the Buffalo district report that most of the consumers in this territory have covered for their first quarter's requirements in bars, shapes and plates at 1.10c, base. Estimates to date indicate that the December buying for material under contract and for immediate needs has exceeded the total for November.

Producers and sales offices calculate that the volume of business being booked is sufficient to warrant a stiffening in prices after the first of the year.

Concessions on Iron Bars

Philadelphia, Dec. 28.—Makers of common iron bars recently have booked a few contracts for first quarter at 1.10c to 1.15c, mill, which is equivalent to 1.16c to 1.21c, Philadelphia, or 1.15c to 1.25c, delivered to points on the seaboard. Some makers are asking the same on spot, but it is known other mills will grant concessions to get attractive spot tonnages. Mills appear now to be running at no more than 25 per cent of capacity.

Steel Bars Unchanged

Chicago, Dec. 29.—The holiday season has had the effect of slowing up the market for finished steel products and no change in this condition is expected until after Jan. 1, when consumers begin to look forward rather than backward. Bars appear to be somewhat steadier than shapes and plates and while they may be bought for immediate rolling and delivery in this vicinity at 1.20c, Chicago, mills are asking 1.29c, Chicago, for first quarter and 1.34c to 1.39c, Chicago, for second quarter. There is no great desire on the part of mills to contract heavily at these prices and consumers appear satisfied to buy on the spot market, under the impression that prices will not advance to the figures asked for future contracts.

Some Advance Jan. 1

Cleveland, Dec. 29.—At least two large independent companies have notified customers that up to Friday, Jan. 1, they will accept specifications for prompt delivery at 1.05c on shapes, bars and plates, but that beginning with Jan. 1, the minimum price for either prompt delivery or first quarter will be 1.10c, Pittsburgh. Other companies, however, do not believe it will be possible entirely to eliminate the 1.05c quotation for prompt delivery and it seems probable that on unspecified tonnages taken at 1.10c for first quarter, 1.05c will be accepted for prompt specifications, until demand shows improvement.

Iron Bars Still Low

Chicago, Dec. 29.—Conditions are unchanged in the bar iron market, the leading producer in this territory continuing to operate at practically full capacity and others running at about 50 per cent. No essential change has taken place in demand and prices remain about the same as for several weeks past. While 1c, Chicago mill, is being asked by most producers, attractive tonnages have been placed recently at $1 per ton less.

Cotton Ties, Hoops, Bands

Pittsburgh, Dec. 29.—The bulk of the cotton ties rolled in western Pennsylvania this year have been shipped to the south. Demand has been satisfactory despite the unfavorable financial situation in the cotton growing states. Government reports indicate that this year's cotton crop will be approximately 16,000,000 bales, involving 3,200,000 bundles of ties. The average crop is about 12,000,000 bales. Cotton ties this year sold at 65 cents a bundle of 45 pounds each, as against 80 cents in 1913 and 70 cents a bundle in 1912. Threatened foreign competition was responsible for the low price this year, announced June 29, last. The market for hoops and bands is unchanged; demand is described as fairly heavy, but specifications are light.

Firm in New York

New York, Dec. 29.—The firming up in prices which has been noted in the plate market the past few days also applies to steel bars. Pittsburgh makers continue to book spot tonnages at 1.05c, Pittsburgh, equivalent to 1.21c, New York, but announce that this price is good only up to tomorrow night. Beginning Thursday, no orders will be taken for less than the regular first quarter price, which is 1.10c, Pittsburgh, or 1.26c, New York. The decision to advance the price on spot naturally has led to the transaction of an improved amount of spot business. As is the case in the other finished materials, consumers of steel bars are eager to contract for their requirements, but the mills are not endeavoring to encourage contract business.

Lowest Prices Disappear.

New York, Dec. 29.—Lower prices were offered in this market on common iron bars for spot shipment last week; it appears these prices were offered by one Pennsylvania maker which desired to work off a surplus tonnage. The lower prices now have disappeared and quotations are unchanged from those quoted previously.

Wire Needed

By Nations at War—Additional Inquiries Received

Pittsburgh, Dec. 29.—Inquiries continue to be received for wire products for shipment to England, France and Russia, but actual buying has not been of much consequence. In addition to inquiries received last week for plain and barbed wire, involving approximately 225,000 tons, makers this week have been asked to bid on 50,000 tons of barbed wire. The domestic situation is quiet. Nails continue to be offered at $1.50 a keg for prompt shipment.

The William H. Grundy Co. will install a modern power plant at Bristol, Pa. The new addition will be of steel and concrete and will be 104 x 111 feet. All the partitions will be of glass to give an unobstructed view of the other rooms. The plant will develop 3,000 horsepower for the seven-story factory.

(*For complete price list see page* 1241.)

Sheets Active, Prices Low

Moderately Heavy Tonnages for First Quarter Sold, But Concessions Are Freely Made in Quotations

Pittsburgh, Dec. 29.—Steel sheet consumers have been figuring in the market for the last 10 days and in the aggregate moderately heavy tonnages for first quarter delivery have been sold. The position of the market is not definitely defined; freight rate differentials are being waived and concessions are being made in many cases when attractive tonnages are involved. While the general market is quotable at 2.80c, 1.80c and 1.35c, for base size, galvanized, black and blue annealed products, respectively, yet those figures sometimes are shaded. Specifications for shipment after Jan. 1 have been rather liberal, and rolling mill schedules probably will be increased early in January.

Little Demand for Sheets

Philadelphia, Dec. 28.—Spot demand for sheets is very poor and is not sufficient to justify the eastern maker in resuming mill operations at the present time. There is a growing desire on the part of consumers, however, to contract for forward requirements. Several contracts were booked last week at $1 to $2 advance over the spot price, which is 1.50c, Philadelphia, or 1.35c, Pittsburgh, for No. 10 gage, blue annealed.

The New York Central has inquired for 1,500 tons of sheets for first half delivery.

Market Stationary

Cincinnati, Dec. 28.—The sheet market is stationary and it is expected by the trade here that it will remain so until after the first of the year. One encouraging feature is that mills are constantly refusing to accept business at reported prices which would be slightly below the market level, and are holding firmly at 3.008c for galvanized sheets No. 28 gage, and 2.008c for black sheets No. 28 gage, both Cincinnati basis. Specifications on old contracts are good and the outlook for better business after Jan. 1 is much better than it was two or three weeks ago.

Sheets Show Weakness

Chicago, Dec. 29.—Steel sheets continue to be weak in the Chicago market and while No. 28 gage black holds comparatively steadily at 1.99c, Chicago, lower quotations for galvanized have been quoted. The leading makers are holding 2.89c to 2.99c for No. 28 gage galvanized, the minimum being for immediate delivery and the maximum for first quarter. However, it is scarcely expected at this time that makers will be able to maintain the higher quotations on business for the new year, and probably this will be lowered shortly. In the face of these quotations, some consumers have received offers of 2.84c for January and February business. This price is not general, but sufficient of it is going to have a decided effect on conditions. Tonnages of sheet mills continue to be far below a sufficient quantity to increase operating schedules and operations are not in excess of 40 per cent.

Low Cast Pipe Prices

Made in Keen Bidding for Chicago Business—Market in East Shows Increased Activity

Chicago, Dec. 29.—Award by the city of Chicago of 7,500 tons of 6, 8 and 12-inch water pipe, requirements for 1915, was the most important event of the week in the cast iron pipe market in the west. This was divided into three equal portions and bids were received on successive days for each portion. The Lynchburg Foundry Co. obtained the first installment on a bid of $21.50, delivered. The American Cast Iron Pipe Co. was low on the second parcel with a bid of $21.35. The Lynchburg Foundry Co. and the United States Cast Iron Pipe & Foundry Co. were tied on the third installment with bids of $21.40. The latter was awarded the tonnage inasmuch as the Lynchburg Co. already had obtained one portion. A contractor has been awarded 189 tons for use at Kansas, Ill., and as a

Heavier Bookings

New York, Dec. 29.—Makers of cast iron pipe report that current bookings are heavier than in several years past and that the total volume of business taken during the month of December is in excess of any single month since 1906. Most of the current lettings are from private buyers. A good many interests, which usually take a few hundred tons at this time of the year, have expanded their requirements considerably and the more important contracts booked recently include lots ranging from 2,000 to 7,000 tons each. Another factor which indicates a tendency toward a more satisfactory situation in the cast iron pipe business is that prices have stiffened somewhat. Bids were opened at Reading, Pa., yesterday, on 1,400 tons. The city of Boston will open bids on Jan. 6 on 4,000 tons.

Dismantling Plant.—The Pacific Coast Steel Co., which purchased the plant of the defunct Western Steel Corporation, at Irondale, Wash., has started dismantling the furnaces and rolling mills with a view to removing usable portions to the plant of the Pacific Coast Steel Co., at Youngstown, a suburb of Seattle, Wash. The machinery will be transported on scows.

Warehouse Business Fair

Cincinnati, Dec. 28.—Warehouse business continues to hold its own in comparison with that of any previous week during the past two or three months. Business is fairly well scattered among the different products carried by local houses and is about equally divided between sources inside and outside of the city. Demand for concrete re-inforcing bars has fallen off slightly since the cold weather set in because of the enforced postponement of concrete work. Prices are unchanged on all stocks and do not exhibit any tendency to fluctuate.

Warehouse Business Slow

Chicago, Dec. 29.—As is usual during the week between holidays, the demand on warehouses is less than it has been in preceding weeks, but this is without significance, as it is a seasonal occurrence and always is expected. No changes have been made in prices and business is keeping up steadily in practically every department.

Bolts, Nuts and Rivets

Pittsburgh, Dec. 29.—Despite efforts to strengthen prices, bolts and nuts continue to sell at rather wide ranges in price, published discounts being shaded in a great many instances. Rivets show no improvement. Railroads are expected to play an active part in the market shortly after the opening of the new year.

(*For complete price list see page* 1244.)

Scrap Dealers Are Firm

Holding Their Accumulations for Higher Prices —Very Few Transactions Recorded

Chicago, Dec. 28.—Sellers of iron and steel scrap in Chicago are holding their accumulations for higher prices and consumers find that when they desire to replace what they have used they must pay more than has been demanded during the early winter. Quotations have responded to this condition and are 25c to 50c per ton higher than the low point. Many shops usually producing scrap in quantity are now running at a low rate and the tonnage of new scrap is not as heavy as in normal times. This has assisted dealers somewhat and the result is that the general level of the market has been advanced.

Consumers who buy scrap for conversion into bar iron find prices for their raw material are advancing more rapidly than is warranted by the market for finished iron bars. What effect this will have on the bar iron market remains to be seen. Only one scrap list is actively before the market at present, the B. & O. offering over 9,000 tons, of which 4,000 tons are No. 1 steel rails.

Strong at St. Louis

St. Louis, Dec. 28.—Dealers in scrap say that conditions are strong, and every indication points to an early advance in prices. Frogs, switches and guards, railroad and agricultural malleable are up 50 cents a ton. The Big Four railroad is out with a list of 4,000 tons of scrap.

Market Quiet

Cincinnati, Dec. 28.—The scrap market continues exceptionally quiet, despite the heavier melt by jobbing foundries. Rolling mills in this territory, which are the largest users of scrap, are gradually curtailing operations, which more than counterbalances the increased consumption by foundries. Railroads have large lists which they are ready to put upon the market and there is a large surplus available both in dealers' yards and throughout the rural districts. Prices are unchanged on all grades of scrap and no new developments are looked for until well after the first half.

Stronger Tone in Philadelphia

Philadelphia, Dec. 28.—A stronger tone in the scrap iron and steel market is indicated by sales of small lots of machine shop turnings and cast borings at 7.75c to 8.25c, delivered eastern Pennsylvania consuming points, which is an advance of ¼c. In practically all other kinds of scrap, business has been at a standstill the past week. Especially dull is the demand for heavy melting steel and the indications do not point to an early improvement, as steel mills, with their present low operating schedules, are not apt to be interested. It is believed steel mills would be glad to contract ahead at the present prices, but dealers are averse to considering such transactions. Dealers report there is plenty of scrap around and that they have no difficulty in securing supplies.

Holding Firmly

Buffalo, Dec. 29.—Prices remain unchanged among the scrap material dealers of the district, although the entire market is pervaded with an absence of trading characteristic of the holiday season. Sellers feel that inquiries and orders will begin to materialize after the opening of the new year and for this reason are holding firmly to schedules.

Only Small Lots.

New York, Dec. 29.—Due to the holidays, the old material market here is unusually quiet. A few small lots have been sold during the week, but no tonnages of importance have developed. Dealers, however, expect better business after the turn of the year, and indications are that a fair demand may develop from around the Pittsburgh district. Prices are unchanged but firm. Dealers report there is plenty of material available to fill their requirements.

Quiet at Pittsburgh.

Pittsburgh, Dec. 29.—The market for iron and steel scrap in western Pennsylvania is almost at a standstill. Jobbers do not expect to see any change in the situation until after Jan. 1, when it is not improbable a moderately active buying movement will be enjoyed. Finishing mills have been building up small back-log tonnages and most of them will need additional material if melts are increased. Middlemen are asking advanced quotations of most grades, but there has been no selling of consequence.

Through a typographical error, it was stated, on page 1171 of the December 24 issue of THE IRON TRADE REVIEW, that, "ordinary Connellsville coke contains approximately 62.5 per cent of fixed carbon and 28.36 per cent of volatile matter." This should be corrected to read ordinary Connellsville *coal* contains approximately, etc.

(*For complete price list see page* 1244.)

Coke Market

Lapses Into Inactivity—Slight Increase of Production

Pittsburgh, Dec. 29.—After several weeks of activity, the Connellsville coke market is quiet. Pending inquiries involve about 20,000 tons of blast furnace coke, negotiations for which probably will not be closed until after Dec. 31. Prices of furnace and foundry coke are unchanged. The Connellsville *Courier*, for the week ending Dec. 19, says production was 198,533 tons, an increase of 2,258 tons compared with the week before.

Inquiry Unclosed

Cincinnati, Dec. 28.—The southern coke market has undergone no new developments during the last week. The inquiry for 15,000 tons of furnace coke from Jackson, O., is unclosed, although several producers have bid upon this business during the week. No inquiries are out from foundries and no other furnaces in this territory are in need of requirements. Prices are unchanged on all grades of Wise county, Pocahontas and New River coke.

Foundry Coke Pending

St. Louis, Dec. 28.—The inquiry for 15,000 tons of foundry coke that has been on the market several weeks is expected to result in a sale within the next few days. Foundry grades of 72-hour Connellsville and Virginia coke are quoted at $2.50. The market is dull.

Tubular Goods Quiet

Pittsburgh, Dec. 29.—There is no snap to the market for tubular goods, and manufacturers do not expect to see any change in the situation until after Jan. 1. Iron and steel pipe discounts are reported to be well maintained, but steel boiler tubes continue to show irregularity. No large orders have been placed and no attractive inquiries are pending, so far as is known.

The Acme Harvester Co., Peoria, Ill., is preparing to reopen its plant after the first of the year. About 1,500 men will be affected. The Avery Co., of the same city, is planning to resume operating Jan. 4, work to start first in the foundry.

Orders for Structural

Include Tonnages for Corrigan-McKinney Blast Furnace Plant—Low Prices Prevail

Cleveland, Dec. 29.—The awarding by Corrigan, McKinney & Co. of 3,000 tons of structural material to the McClintic-Marshall Co. for a power house and cast houses, and 1,600 tons to the Variety Iron Works Co. for ore bins and coal and coke trestles at the blast furnace plant of the company was at very low prices. It was understood that the price was about $45, erected, which, with the ordinary estimates for fabricating and erecting, would allow only about 1c per pound, Pittsburgh, for the plain material. The city of Cleveland, realizing that now is the time to let contracts for new construction, is anxious to proceed with the building of the Clark avenue high level bridge, which will require about 8,000 tons of steel, but this work is prevented at present by an injunction suit. An early decision favorable to the city is hoped for.

On 1,300 tons for the Division avenue pumping station, the McClintic-Marshall Co. was successful bidder, its bids on three items being 2.72c, 3c and 5c. The next lowest bidder was the Massillon Bridge & Structural Co., which bid 2.75c, 5c and 7.50c, respectively, on the three items. The American Bridge Co. bid 3.19c, 4.95c and 9.50c, the King Bridge Co., 3.25c, 5.10c and 8.35c, and the National Iron & Wire Co., 2.87½c, 4.25c and 10c.

Several Contracts Placed

Pittsburgh, Dec. 29.—Contracts for about 4,000 tons of fabricated material have been placed with a couple of concerns in this district the last few days, and several interesting undertakings are under consideration. The Jones & Laughlin Steel Co. has taken an order involving 1,000 tons and the McClintic-Marshall Co. has received orders for about 3,500 tons. While fabricators appear more cheerful about the future, prices continue very low.

Increased Activity

Philadelphia, Dec. 28.—Despite the holiday season, the structural shape market in this territory reflects more activity than in preceding weeks. This is due to the placing of numerous orders for small lots aggregating a total of 1,500 to 2,000 tons. A feature of the week was the demand from the railroads, which placed several orders and put out some inquiries, all involving small tonnages. Prices appear to be somewhat firmer and it is believed 1.10c, Pittsburgh, or 1.25c, Philadelphia, cannot be shaded for the first quarter. For second quarter, 1.15c, Pittsburgh, or 1.30c, Philadelphia, is asked. An effort has been made by some sellers to get 5c more per 100 pounds on plate and shape contracts than for bars, but so far this has been unsuccessful. Consumers are manifesting greater anxiety to get under cover, with the result that considerable contracting was done last week. Sellers, however, do not encourage the making of contracts, as they expect to see higher prices next year. The mills, however, are anxious to get spot business, with the result likely that tonnages can be had at 1.05c, Pittsburgh, or 1.20c, Philadelphia.

It is interesting to note that on small structural tonnages, bids covering material, fabricating and erection, lately have been averaging between $42 and $45 per ton, on such tonnages as involved only beams and columns and the usual angles, plates, etc. In some cases, as low as $36 per ton has been bid, which figure also included erection; this job, however, included only beams and angles, without columns.

Spot Tonnage Improves

New York, Dec. 29.—The structural shape business has been coming along a little better the past week, due to the placing of a fairly good-sized aggregate of spot tonnages. None of these tonnages were of importance in themselves, but formed a fair total. There are no important inquiries in the market at present. Consumers show a little more desire to contract ahead and some further contracts have been closed for first quarter. On these the price has been uniformly 1.10c, Pittsburgh, or 1.26c, New York. On spot, 1.05c, Pittsburgh, or 1.21c, New York, is being done, but it is believed that this low price will disappear after the end of the year.

Structurals are Weak

Chicago, Dec. 29.—Structural shapes are exceedingly weak and are obtainable for immediate specification at 1.20c, Chicago. Mills for first quarter delivery are asking 1.29c.

Tonnages awarded during the past week aggregate almost 5,000 tons, the greater portion of which went to a cotton warehouse in New Orleans and a pipe line for Oregon, Ore.

CONTRACTS AWARDED.

Corrigan, McKinney & Co., Cleveland, ore bins and trestles at blast furnace plant; 1,600 tons; to the Variety Iron Works Co., Cleveland. Plain material will be furnished by Jones & Laughlin Steel Co.

Alterations to cooling plant at Union Stock yards, Pittsburgh, 1,000 tons, awarded to the Jones & Laughlin Steel Co.

Troop I armory, Buffalo, 300 tons, awarded the McClintic-Marshall Co.

Corrigan, McKinney & Co., Cleveland, power house and cast houses; 3,000 tons; to the McClintic-Marshall Co.

Fabricated plates for pipe line for Oregon City, Ore., 2,816 tons, to Willamette Iron & Steel Co.

Board of Port Commissioners, New Orleans, La., cotton warehouse, New Orleans, La., 1,500 tons, to McClintic Marshall.

Coal handling machinery for St. Louis, 428 tons, to Joliet Bridge & Iron Co. (Owner not divulged.)

Crown hotel, Cleveland, 600 tons to Forest City Steel & Iron Co.

Oil tanks at Baltimore for the Prudential Oil Co., 800 tons; name of taker not announced.

Fore River Ship & Engine Co., Quincy, Mass., 350 tons, for addition; name of taker not announced.

Theater building at Yonkers, N. Y., 500 tons, to Levering & Gerrigues.

Division avenue pumping station, Cleveland; 1,300 tons; McClintic-Marshall Co.

CONTRACTS PENDING.

Cleveland Worsted Mills Co., Cleveland, dye house at Ravenna, O., 500 to 600 tons.

New building for Pittsburgh Plate Glass Co. at Clarksburg, W. Va., about 800 tons; contract probably will be formally awarded this week.

Section No. 4 of the Broadway-Fourth avenue subway extensions, New York City, 4,860 tons; taking of bids again deferred from Dec. 29 to a date not yet announced.

Five bridges for the Pennsylvania railroad, 700 tons; bids received Dec. 23.

Power house for Victor Talking Machine Co., Camden, N. J., 600 to 650 tons; bids in Dec. 28.

(For complete price list see page 1244.)

English Pig Iron Stocks

New York, Dec. 29.—During the week ending Dec. 18, stocks of pig iron in Middlesbrough, Eng., showed a decrease of 721 tons, which makes a total decrease for the year of 36,072 tons. Cumberland stocks were unchanged from the preceding week.

Furnaces in blast in the Middlesbrough district on Dec. 18, numbered 74, compared with 73 the preceding week and 76 the corresponding week a year ago, and in the Cumberland district, 21 compared with 22 the preceding week and 23 the corresponding week a year ago. Furnaces in blast in Scotland numbered 68 on Dec. 18, against 68 the preceding week and 73 the corresponding week last year.

The National Brick Manufacturers' Association will hold its annual convention at Detroit, Feb. 14 to 20. This gathering will also bring to Detroit members of the National Paving Brick Manufacturers' Association, the National Clay Machinery Association and the American Ceramic Society.

Plate Prices

Show More Firmness and Spot Business Improves

New York, Dec. 29.—The feature of the plate market in this territory is the firming up of prices during the past week. On first quarter, nothing less than 1.10c, Pittsburgh, or 1.26c, New York, can be done, while second quarter is held at 1.15c, Pittsburgh, or 1.31c, New York. While some makers now are refusing to take spot tonnages at less than 1.10c, Pittsburgh, others still are quoting 1.05c, Pittsburgh, or 1.21c, New York. These makers, however, announce that these low prices are available only today and tomorrow, and that beginning Thursday, they will refuse to book anything at less than 1.10c, Pittsburgh. As a result of the decision to raise their level, an improved spot business is being done. This, however, is mostly in small tonnages. Although there is considerable anxiety on the part of consumers to make contracts, the mills are not eager for such business, soliciting only definite orders. The mills refuse to make contracts with jobbers for longer than three months ahead. The New York Central is inquiring for a limited tonnage of plates.

Would Like to Contract

Philadelphia, Dec. 29.—Plate mill schedules of operation did not undergo any important change in eastern Pennsylvania last week, as very little spot business was placed. The only features of the market were the desire of consumers to make future contracts, and a firming up, to some extent, of the market. It is believed that less than 1.10c, Pittsburgh, or 1.25c, Philadelphia, could not now be done on first quarter, while 1.15c, Pittsburgh, or 1.30c, Philadelphia, is asked for second quarter. Spot generally is quoted at 1.10c, Pittsburgh, or 1.25c, Philadelphia, but 1.05c continues to be done occasionally. The eagerness of consumers to safeguard themselves with contracts is attributable to a general belief in this market that higher prices will be seen next year. Sellers booked a number of contracts for first quarter last week, but are endeavoring to stay away from contracts as much as possible. Some small shape inquiries have come from the railroads and an improvement in buying by these interests is expected.

Plate Prices Weak

Chicago, Dec. 29.—Weakening of prices for steel plates characterizes the mid-holiday season. The leading makers are openly quoting 1.20c, Chicago, for immediate business and anything at all attractive on which specification accompanies the order can demand this price. The market here apparently is considerably weaker than further east and no difficulty is experienced by consumers in obtaining a price which would figure back to approximately 1c, Pittsburgh. In spite of this low figure for immediate business, mills are asking 1.29c, Chicago, for contracts through first quarter, and $1 per ton higher for second quarter.

Will Protest

Against Bills to Prohibit Shipments to Belligerents

Washington, Dec. 29.—Manufacturers will appear tomorrow at the hearing before the house foreign affairs committee on the joint resolutions of Representatives Bartholdt and Vollmer to prohibit exportation from this country of munitions of war. The manufacturers will enter vigorous protest against the resolutions, it is expected, while supporters of the measures will warmly defend their purposes. Injury to American industry will be cited as one reason why the measures should not be enacted. In the senate are two resolutions of similar character, one having been presented by Senator Hitchcock and the other by Senator Works.

METAL MARKETS

New York

Dec. 29.

Aluminum.—There is fair activity in the aluminum market and a few good tonnages have been closed and several are under negotiation for the first half of next year. The largest contract placed was one for 2,000 tons for first half delivery at the plant of the Willys-Overland Co. by the domestic producer. It is said that 19c, Niagara Falls, was the price agreed upon. Quotations are somewhat higher, due partly to the improvement in demand and partly to the fact that nearly all of the spot supply is in the hands of the domestic producer. Spot and futures for guaranteed delivery are quoted at 19c to 19.50c. English aluminum can be had at 18.50c to 19c, duty paid New York, but deliveries on contracts for this metal, are not guaranteed.

Antimony.—Demand for antimony continues very dull but some prices are higher. Cookson's is unchanged at 15c duty paid, New York, but Hallett's is held at 14c to 14.50c and Chinese and Japanese at 12c. These prices are for spot shipment. A feature which indicates the extent of recent Russian purchases of antimony in Japanese is that Chinese and Japanese brands for January and February shipment are offered at less than 11.50c to 12c in bond at New York, which is a premium of nearly 2c per pound.

Spelter.—The situation in spelter is unchanged, excepting that further efforts to bring out buying have resulted in bringing down the market to 5.30c to 5.35c, St. Louis, which is equivalent to 5.47c to 5.52c, New York. Very little domestic business is being transacted and there is a halt in the booking of new business for export. This is due to a smaller demand and also to the difficulties arising from present high ocean freight rates. The lead market is unchanged. While the leading interest continues to ask 3.80c New York, or 3.72½c, St. Louis, the metal continues freely available in the outside market at 3.60c, St. Louis, which is equivalent to 3.77c, New York. Current bookings are of small proportions.

Copper.—There are rumors that producers of electrolytic would entertain offers of 13.25c, delivered 30 days. While the market certainly has a weaker tone, due to the low offers being made by second hands, the situation, as far as first hands is concerned, is entirely nominal, due to the lack of business. Several leading selling agencies say they still are holding firm for 13.50c, delivered 30 days. The outside market on electrolytic now can be quoted at 13c to 13.12½c, delivered 30 days, at which prices, or their equivalent, limited tonnages can be had. While some producers of casting copper continue to hold for 13.30c to 13.35c, delivered 30 days, as much of the metal as is desired can be had from second sellers at prices equivalent to 12.90c to 13c, delivered 30 days. There is almost no business at the present time. Sellers of prime lake, due to the weakness in the copper market, as a result of the activities of second sellers, now are willing to sell ordinary brands at 13.25c, cash. Some second sellers say they have prime lake to sell at 13c but it is not believed that much metal is available at this low figure. There is very little demand for lake. The announcement that the government at Washington has issued an emphatic protest to the British government in regard to the activities of British vessels in interfering with our export shipments, is of particular interest to the export trade and considerable satisfaction over the government action is expressed by the producers. The reply by the British government, which is expected shortly, is awaited with interest.

Tin.—The tin market has been absolutely stagnant all day and although sellers are fairly numerous and have offered rather persistently, no sales of spot are believed to have resulted. Spot was offered this morning at 34c for out-of-town shipment and by the close of the afternoon, had declined to 34.50c. City delivery this afternoon is quoted at 33.37½c to 33.42½c. There was a fair volume of business today for January, February and March, the limits on these months being 32.75c. The fact that 32.50c was declined for February and March, indicates that futures are quite strong. There were few sales in London today. There is a general tendency among tin consumers to wait for the publication of the tin statistics at the end of the month before committing themselves any further than their requirements necessitate.

Copper Exports

New York, Dec. 29.—According to advices from Washington, the American copper exports to Europe reached a total of 30,724,367 pounds, valued at $3,825,474 in the first three weeks of December. Nearly half of that total, or 14,862,158 pounds, was exported in the week ending Dec. 19. Of the latter amount, France was the largest purchaser, taking 6,976,996 pounds; Italy second with 3,457,042 pounds and England third with 3,209,461 pounds.

(*For complete price list see page* 1244.)

Labor Shortage in Great Britain

Enlistments Interfere With Industrial Operations—Higher Prices for Pig Iron—Active Demand for Most Finished Products

Office of THE IRON TRADE REVIEW,
Prince's Chambers, Corporation St.,
Birmingham, Dec. 18.

The bombardment of Scarborough, the Hartlepools and Whitby furnishes a new experience for Britishers, as this is the first event of the kind for hundreds of years. Some iron folk have sought to extract iron trade significance from the raid, suggesting that as this is the pig iron area, being in fact within a few miles of Middlesboro, nothing would be easier than for Germany to carry off our pig iron stores, if she were so disposed. This, it perhaps need hardly be said, is not a sequel we are looking for. We all regret the very sad deaths of so many women and children, some of the latter very young children; but perhaps this taste of the reality of war, which hitherto has not yet come home to us, will stimulate recruiting. Indeed it has already had this effect. The real obstacle to recruiting, however, is the scarcity of labor. Trade is now calling for many more men than can possibly be obtained. A large Birmingham railway depot has this week fetched a strong contingent of Yarmouth fishermen to assist in dealing with the Christmas traffic, which seems to be heavier than usual. Transit is, in fact, rapidly becoming unmanagable. Labor on the land is also getting very scarce, and a local colliery has this week had to cease operations, through so many enlistments.

This is the principal trade difficulty now. There is no scarcity of work, except in one or two industries, such as jewelry. Even building is now looking up. Gold is more plentiful than ever. Orders for shipbuilding are also abundant. *The Shipbuilder* has just published particulars of 50 meat-carrying steamers, colliers and dredges ordered from the Clyde and North-East coast shipbuilding yards during last month. This is the longest monthly list ever published, but it is not exhaustive. Some firms have 12 months' orders booked. With regard to the gold stocks, the amount now held by the Bank of England is £89,000,000, or twice the value of the paper money in circulation.

Bodies Burned

A new use for blast furnaces is suggested by a report from a correspondent of the *Daily Telegraph*.

"Since the fatal attacks on Ypres and the Yser a new source of interest has been created for Brussels people. Namely the trains of the dead. These pass through the suburb of Lackan, by way of Louvain and Liege, to Germany, to be burnt in the blast furnaces. The dead are stripped, tied like bundles of asparagus, stacked upright on their feet, sometimes bound together with cord, but for the most part, with iron wire. Two to three thousand pass with each train sometimes, in closed meat trucks, sometimes in open trucks, just as it happens."

Pig Iron Advances

The best evidence that the German raid has not alarmed shippers or checked pig iron buying, is shown by the further decided rise in pig iron values. The latest quotation at Middlesboro is 53s 4½d ($10.41), a few pence below the highest of the week, namely 53s 11d ($10.54) representing a rise of 2s 3d (54c) on the week. The tone is confident, and consumers everywhere are hastening to secure their contracts before quotations run away. The standards on the Birmingham market yesterday were quite a shilling (24c) above those of a week ago, and sellers were careful not to commit themselves too heavily, in view of the prospect of higher prices in the new year. In Cleveland, a premium of 1s (24c) is asked for all forward business. Prices there are the best since August, by 8d (16c) per ton. The improved tone has been assisted by the better war news, and especially by the more cheerful advices from America. Cleveland shipments this month have reached 12,000 tons, and stocks have been reduced by 3,000 tons. Cold blast iron for rollmaking is in better demand. East-Coast hematite is rising in price, and in very good demand. Prices have advanced to 70s ($16.80) for East-Coast mixed numbers. The demand also includes Scotland and Barrow-in-Furness. The output of the 21 furnaces in blast is booked for several months to come. Prices are higher this week at 72s 3d ($17.34) to 73s 6d ($17.64) net f. o. b. Large quantities of special iron are being sent to every steel-making district. In view of the very large and growing demand for steel, the market is extremely firm.

Expectations of a boom are now becoming very common, and indeed are generally talked of. This applies especially to steel, the demand for which is enormous. This week joists, which were excluded from the last advance, have been put up 5s ($1.20) per ton, and all other descriptions are harder. War orders are very numerous, and to an increasing extent include supplies to our allies. Steel works have booked heavy lots of shrapnel steel, at good prices. This has had a very important effect on the semi-steel market. The representative of a large Welsh steel works explained the matter to the writer by remarking: "It is hardly likely we are going to roll bars and billets when we can get £13 ($62.40) or £14 ($67.20) per ton for shrapnel steel." This will partly explain why semi-steel has become scarce and difficult to get. Some firms are asking £6 ($28.80) per ton for Siemens billets, with the deliberate object of shutting off business. It is expected here that this will give Americans a better chance of competing than they have yet had. In regard to wire rods, a large Birmingham buyer is now getting Canadian rods at £7 ($33.60), delivered in Birmingham. As finished wire made from these rods is selling at £9 15s ($48.80), this is a workable proposition, and the buyer is very glad to be independent of British makers, who have not been at all anxious to help him over his difficulties.

Some representatives of the government have been in the district this week endeavoring to induce owners of various works to join in the making of shell material. A rise of 10s ($2.40) has been declared in high carbon steel billets. A considerable amount of special structural contracts are on offer, in connection with war business. A remarkable feature is the practical absence of railway orders. The home lines are running their stocks of material very low, and must come into the market very soon.

Very good orders for thin sheets have been placed by home and foreign governments for aeroplane work. Scotch plate mills are running full time for the shipbuilders. Tube makers are doing only a moderate business. In the iron trade, most of the Black Country works have three months' work in sight, and prices are hardening. Some makers have increased their unmarked bars 2s 6d (60c) during the last week. Galvanized sheets are not much called for, and the price of £11 ($52.80) as a minimum, it is complained, leaves lit-

tle or no profit. Mills in this line are doing nothing like full time. Tin plate mills are still worse off for business, and can scarcely keep going. Railmakers are a little better employed, but mainly on foreign account.

The chain and anchor trades are extremely busy, and of 1,350 men in the Chainmakers' Society not one received a penny of out-of-work pay during the last month. Such a state of things has not been known for 25 years.

Some very good work is being done in connection with the turning out of ships of war. Messrs. Cammell-Laird have just completed the light cruiser Caroline and delivered it ready for service, seven months under contract time.

A few days ago the following message was sent to Palmer's ship yard at Jarrow from the King: "His Majesty appreciates the loyal and untiring service which is being rendered to the country by skilled workmen in the great shipbuilding and armament firms. His Majesty greatly admires the spirit of patriotism which arouses in them a desire to enlist to fight at the front, but his Majesty wishes to remind them that by work they alone can most successfully perform they are assisting in the prosecution of war equally with their comrades serving by land and sea."

Group Plan

Not to be Interfered With in Readjusting Rates

Washington, Dec. 29.—The interstate commerce commission this morning entered an order relating to the 5 per cent advance rate case allowing carriers to preserve the grouping of points of origin and destination in central freight association territory which have heretofore been observed in making joint rates between that territory and the southwest. Provision is also made that through class rates applying in both directions between central freight association territory and the southwest may be advanced subject to the western classification. These group points include Louisville, Cincinnati, Dayton, South Bend, Detroit, Cleveland and Pittsburgh, and advances range from 0.5 cent to 2.7 cents per 100 pounds. Where inter-territorial joint through rates have heretofore been published on the combination of intermediate rates to and from the Ohio and Mississippi river crossings the amount of the increase in the joint through rate will not be greater than the amount of the increase in the rate of the central freight association territory lines to or from the gateway.

The order also says that no increased rates shall be established upon commodities as to which increased rates within central freight association territory have not been authorized. Included in this list are coal, coke and ore.

Pipe Product

Statistics Collected by American Iron and Steel Institute

At the request of the manufacturers, the bureau of statistics of the American Iron and Steel Institute has ascertained the approximate production in the United States in 1913 of wrought iron and steel pipe and boiler tubes, seamless hot-finished and cold-drawn steel tubes, iron and steel galvanized sheets (including products formed or stamped from iron or steel black plates or sheets and galvanized after the completion of the forming or stamping process), and cast iron gas and water and soil and plumbers' pipe and fittings.

The production of wrought iron and steel pipe and boiler tubes in the United States in 1913 amounted to approximately 2,245,532 gross tons, of which about 276,067 tons were iron and about 1,969,465 tons were steel.

Of the total, 830,472 tons were black standard pipe, of which 120,619 tons were iron and 709,853 tons were steel; 266,940 tons were galvanized pipe, of which 25,323 tons were iron and 241,617 tons were steel; 841,089 tons were oil country goods, of which 84,778 tons were iron and 756,311 tons were steel; 179,211 tons were O. D. and miscellaneous pipe, of which 2,159 tons were iron and 177,052 tons were steel; and 127,820 tons were boiler tubes, of which 43,188 tons were iron and 84,632 tons were steel.

The production of hot-finished and cold-drawn seamless steel tubes in the United States in 1913 amounted to approximately 108,567 gross tons, of which about 42,740 tons were hot-finished tubes and about 65,827 tons were cold-drawn tubes. It was necessary to estimate the output of a few plants.

The water commission, Oregon City, Ore., has accepted the bid of the Oregon Engineering & Construction Co., at $315,000, for constructing the gravity pipe line for the proposed water system. Riveted steel pipe is specified and same will be made by the Willamette Iron & Steel Works, of Portland. Project is conditioned on the voting of bonds to finance the same.

Higher Price

Asked for Shapes, Plates and Bars by Leading Companies

Pittsburgh, Dec. 30. (By wire.)—The Carnegie Steel Co. has wired sales representatives that effective today it no longer will accept contracts for plates, shapes and bars for first quarter delivery at less than 1.10c, Pittsburgh, and directed that a 1.15c quotation be asked for material for second quarter shipment.

Independent manufacturers had adopted similar prices which indicates that the prevailing 1.05c price for immediate shipment probably will disappear before tomorrow night.

So far as can be learned, all makers in western Pennsylvania now are uniformly quoting plates, shapes and bars at 1.10c. No attempt is being made to re-establish the old differential which gave makers a higher price for plates and shapes than for bars, as all three products are being named at the same level.

Rail Inquiry

Included With Other Products Needed by New York Central

New York, Dec. 30. (By wire.)—Lehigh Valley pier No. 8, calling for 1,000 tons, has been awarded to Levering & Gerrigues. The New York Central inquiry, in addition to spikes, bolts and sheets, includes 10,000 tons of bars, shapes, plates and 4,500 tons of rails for Boston & Albany.

New York Central Inquiries

New York, Dec. 29.—The New York Central, in addition to inquiring for 1,500 tons of sheets for delivery over the first half of 1915, has inquired for 2,000,000 to 3,000,000 bolts and 30,000 kegs of spikes.

Almirall & Co., Inc., 1 Dominick street, New York, has succeeded the partnership formerly conducted under the name of Evans, Almirall & Co., by Q. N. Evans, J. A. Almirall and W. C. Adams. The firm has been dissolved owing to the death of Quimby N. Evans. The company installs heating, ventilating and sprinkler systems, power plants, etc.

Through error, the name of the manufacturer of the light forging hammer described on page 1185 of the December 24 issue of THE IRON TRADE REVIEW was omitted. This hammer is manufactured by H. Edsil Barr, 922 State street, Erie, Pa.

Death of Thos. Lynch

Thomas Lynch, president of the H. C. Frick Coke Co. and a director of the United States Steel Corporation, died Dec. 29 at his home in Greensburg, Pa. He was one of the pioneer coke oven operators in the Connellsville region and as head of the Frick properties occupied a position of prominence in the coke and allied trades.

Mr. Lynch has been ill for several weeks, but his condition was not considered serious until a fortnight ago, when he was attending an executive meeting in New York City. Upon returning to his home at Greensburg, he underwent an operation Dec. 16 for peritonitis, which was pronounced successful. He appeared to rally and hopes for his recovery were expressed. Death was due to exhaustion and inability to take nourishment after the operation.

Mr. Lynch was born in Uniontown, Pa., Aug. 13, 1854. He was the son of Patrick and Anna Lynch, both natives of Waterford county in the province of Munster, Ireland, who immigrated to this country shortly before Mr. Lynch was born. The older Mr. Lynch was a prominent contractor in Fayette county, Pa.

Thomas Lynch attended the public schools in Uniontown until he was 17 years old, when he accepted a position as clerk in a store at Furnace, in Fayette county. In 1875, he became identified with the H. C. Frick Co., which was organized in 1882 as the H. C. Frick Coke Co. At the time of its organization, the company owned 50 coke oven plants and about 500 acres of coal. Mr. Lynch started with the Frick company as a clerk in the company's store at Broad Ford.

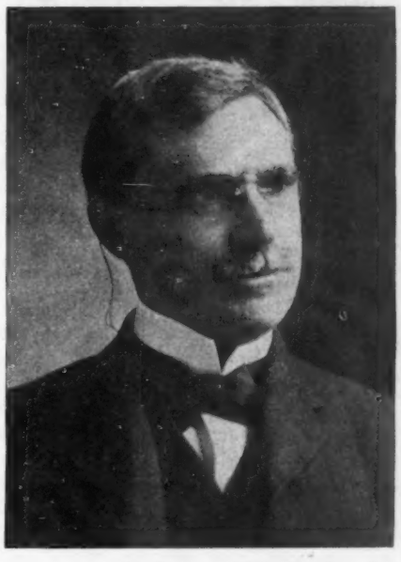
In 1877, the Frick company purchased the Valley Works in Fayette county and in the following year Mr. Lynch was appointed superintendent of the plant. Two years later, the company leased the properties of the Anchor and Ferguson interests at Dunbar and Mr. Lynch took charge of the works at that place. In 1890 he was made general superintendent of the Frick company and since that time has been in active charge. When Mr. Frick resigned as president of the company in 1896, Mr. Lynch was elected his successor. The company had been expanding rapidly, owning about 40,000 acres of coal land and operating approximately 12,000 ovens when Mr. Lynch became its head.

Mr. Lynch was president of a number of subsidiary companies of the Frick company, including the United States Coal & Coke Co., of West Virginia; Bunson Coal Co., of Illinois; National Mining Co., of Pennsylvania; Sharon Coal & Limestone Co., of Sharon, Pa.; Republic Coke Co., and the Hostetter-Connellsville Coke Co., Uniontown. He was a director of the Mellon National Bank, of Pittsburgh.

Mr. Lynch was married to Sarah Agnes McKenna, of Pittsburgh, in 1879. She, with seven children, survives him.

The American Magazine for January publishes an article by Miss Ida M. Tarbell on "The Gospel of Safety", in which she tells of the wonderful progress that has been made in promoting safety in industrial plants in recent years. She gives Thomas Lynch credit for being one of the pioneers in this movement. She says he made the rule "Safety Must be the First Consideration" at least 15 years ago. She adds:

"Not the least of the values the



THOMAS LYNCH

Steel Corporation received when in 1900 it absorbed Mr. Lynch's concern was the slogan 'Safety the First Consideration'; though if anybody at that time had suggested to the makers of that aggregation that the little phrase had a value he would probably have met with derision.

"Certainly, if the directors of the Steel Corporation had been told 10 years ago that they would soon be spending three quarters of a million of dollars annually in accident prevention, would be giving of their own time and that of hundreds of employes, that they would be running hospitals and a museum, publishing books and pamphlets on safety and sanitation, they would have resented the allegation as a reflection on their business sense. Mr. Gary had difficulty enough in 1900 in committing his directors to a policy of publicity. If he had suggested the present policy of safety, his unfitness for the position would have been conclusively demonstrated! 'If I had asked five years ago for money to do what I am urged to do today by the directors of this concern,' the superintendent of a big rolling mill said to me not long ago, 'I would have been discharged on the spot.'"

As illustrating the impression that the safety rule makes on workingmen, Miss Tarbell publishes a fac-simile of a letter addressed "Safety the First Consideration, Smocks, Pa." by a workingman who knew the slogan if not the name of the company which employed him. The postmaster at Smock knew both and without hesitation forwarded the letter to the H. C. Frick Coke Co.

Obituaries

Dr. Charles Martin Hall, Niagara Falls, N. Y., one of America's foremost chemists and the inventor of the process by which aluminum is made on a commercial scale in this country, died on Dec. 27, at Daytona, Fla. Dr. Hall was 51 years old and had been ill for several years. He had gone to Daytona for his health. When Dr. Hall was a boy in Thompson, O., where he was born, he first became interested in chemistry. At that time, aluminum was worth about $25 a pound. In 1885, Dr. Hall first turned to electrolysis as a means of obtaining aluminum from alumina, and on Feb. 10, 1886, he successfully produced the metal by this method. Dr. Hall was forced to go to the United States courts in order to sustain the validity of his patent. In 1888, the patent was granted by Wm. Howard Taft, then a federal judge, and Dr. Hall at once started to produce the metal in a laboratory at New Kensington, near Pittsburgh, producing 50 pounds a day at $2 a pound. He soon erected larger works at Niagara Falls and the industry has grown until at present the company operates five establishments. Dr. Hall was the recipient of numerous medals, in recognition of his discoveries, and he was a member of numerous technical societies.

James William Phyfe, founder and senior member of the firm of Jas. W. Phyfe & Co., 123 Front street, New York, died on Dec. 25 at his home in that city. Jas. W. Phyfe & Co. are large importers of East Indian merchandise and are active particularly in the importation of tin.

John Truslow, retired stove manufacturer of Brooklyn, N. Y., died on Dec. 24 in Brooklyn. He was 87 years of age.

MEN OF THE IRON TRADE

Who they are Where they are What they are doing

William E. Corey, former president of the United States Steel Corporation, visited the plant of the Homestead Steel Works of the Carnegie Steel Co. last week.

Quincy A. Shaw, Boston, president of Calumet & Heela Mining Co., has been compelled to relinquish all business activities by reason of a nervous breakdown due to overwork. Mr. Shaw for the present is resting at his home.

Harold Mackenzie, of Trenton, N. J., son of Dr. Thomas H. Mackenzie, has gone to lower California in the interests of James Hayes Hammond, the famous mining engineer and promoter. He will look after the Hammond mine interests there.

E. A. Silagi, a representative of the Trussed Concrete Steel Co., Detroit, is reported to be a British prisoner of war at Singapore, Straits Settlement, India, where he was in charge of work for the Detroit concern. Mr. Silagi is a Hungarian by birth.

Selig Morris has retired from the firm of S. Morris & Co., Chicago, dealers in scrap iron, steel and metals. Mr. Morris had been in active service for more than 40 years. His former partners, George F. Davis and Louis Morris, will continue the business.

Leo C. Steinle, general European representative of the Pratt & Whitney Co., Hartford, Conn., returned from Europe, Dec. 19, to remain in this country for a short time. Mr. Steinle as a rule makes his headquarters in Berlin, but during the past six months has been mostly in Paris.

A. M. Little, superintendent of the galvanizing department of the Reeves Mfg. Co., Canal Dover, O., has resigned to accept a position as superintendent of the new galvanizing plant of the Newport Rolling Mill Co., Newport, Ky. He will take charge of the new department Jan. 2.

H. B. Jay, president of the Packard Motor Car Co., Detroit, was operated upon at a New York hospital Dec. 4, for an affection of the scalp, resulting from an injury recently sustained while touring, which was regarded as trivial at the time. His present condition is reported to be very favorable.

Dr. Oshima and P. Futjita, of Tokyo, Japan; Z. G. Woo, Z. N. Kwank and T. C. Hsn, of Hang Ying, China, and Thomas Bunt, of London, who have been inspecting steel plants in this country the last few weeks, are now visiting mills in the Pittsburgh district. They represent the Hanyehting Coal Co., Shanghai, China.

E. G. Niesswaner has been elected president of the American Cold Japan Co., 2302 Penn avenue, Pittsburgh, manufacturer of rust and acid-proof paints for structural iron, which was recently reorganized. E. G. McAleenan, formerly of the McAleenan Boiler Co., Pittsburgh, is secretary and sales manager of the American company.

Edmond Raftery will become president and general manager of Cribben & Sexton Co., Chicago, Jan. 1. Mr. Raftery has been identified with the stove business in this country for much of his active life and was associated with the Rathbone, Sard & Co., at Albany, N. Y., and was made vice president and western manager of this company's works in Aurora in 1890.

Albert E. Manchester, Milwaukee, superintendent of motive power for the Chicago, Milwaukee & St. Paul Railway Co., and general manager of its West Milwaukee locomotive, car and repair shops, celebrated his fiftieth anniversary of his affiliation with the system, Dec. 16. In the evening, Mr. Manchester was guest of honor at a banquet tendered by officials of the Milwaukee road, 500 being present.

J. W. Payne, formerly manager of the San Francisco office of the American Optical Co., has been appointed Pacific Coast branch manager of T. A. Willson & Co., Inc., Reading, Pa., makers of eye protectors and goggles. The San Francisco office will be located in the Head building. The Willson company also announces that it can give excellent service abroad through S. Pulzer, 9 Hatton Garden, London, Eng., who carries a heavy stock of goggles in that country.

William A. Stanton, vice president and general manager of the General Refractories Co., was the guest of honor at a dinner given at Delmonico's, New York City, Saturday evening Dec. 5, upon the occasion of his fiftieth birthday. William C. Sproul, president of the General Refractories Co., acted as toastmaster. Responses were made by Frank Trumbull, chairman of the board of the Chesapeake & Ohio railroad, and others. A number of prominent steel men were in attendance. Mr. Stanton was the recipient of numerous gifts including a silver set and a watch of platinum.

President Charles M. Schwab played the role of Santa Claus to 150 of his close associates in the Bethlehem Steel Co. by presenting them pearl inlaid platinum watch charms. The presentation was made by his secretary, J. M. A. Ward. The total cost of these presents was said to be about $22,000. Mr. Schwab's annual dinner to the superintendents of the plant at South Bethlehem, Pa., will be held on Jan. 5, the rush of business in Europe preventing it being held at the usual time this year.

Leonard J. Lewry, who went abroad May 30 to establish agencies for the American Rolling Mill Co., Middletown, O., in Russia, Norway, Sweden, Japan, Chile and Egypt, returned the past week. Mr. Lewry suffered severe inconvenience to his plans and travels as a result of the outbreak of the war, but he reports a very successful trip. Speaking of conditions in Russia, where he spent considerable time, he says he has marveled at the imperturbability of the population over the war, neither victories nor defeats exciting them, and they have absolute confidence in the final victory of their armies. In the interior of the country, he said, business was going on in a normal way.

Alleged Attempt to Blow Up Plant

New York, Dec. 29.—It is reported from South Bethlehem, Pa., that detectives employed at the plant of the Bethlehem Steel Co, recently found a heavy charge of explosives beneath one of the main buildings and subsequently discovered bombs in other sections of the works. President Chas. M. Schwab has refused to confirm or deny the reports in regard to the attempt to blow up the plant. It is considered possible that the placing of the explosives is a result of the activity at the Bethlehem plant in the manufacture of shrapnel and armament for the use of the belligerent powers in Europe.

The International Iron & Steel Construction Co., of Evansville, Ind., has changed its name to the International Steel & Iron Co.

Money and Iron: Fact, Comment

Old Year One of Exceedingly Small Profits

But Retrenchment Policies Have Kept Many Companies Out of Bankruptcy—Insurance as a Method of Recognizing Faithful Service—News of the Financial World

"If there had been no war"—that is the way financial reviews are likely to begin at this time of the year, and then go on to tell what might have happened. Some reviewers believe that on Aug. 1 there was a fine prospect of the return of prosperity, while others say that the war has helped more than it has hurt. Little will be accomplished by speculation as to what might have been. The fact is that from the standpoint of profits 1914 has been one of the poorest in many years. Owing, however, to the fact that rigid retrenchments were adopted in time, bankruptcies have not been as numerous as in other periods of depression. Among the companies which suffered most severely were those operating vessels on the Great Lakes and not connected with any manufacturing concern. For such independent lines, receipts have been extremely small, but in their cases, as in those of manufacturing concerns, careful financing of earlier years has avoided embarrassment. One company declared a 10 per cent dividend the other day, as compared with 18 per cent in 1913.

As to the outlook, the general feeling is optimistic. The unprecedented strain due to the war has been met and all the financial difficulties encountered have been overcome to a large extent. New problems may, of course, appear, but the disposition is not to borrow trouble.

Insuring Employes

In spite of the hard times which have made it impossible for many companies to share profits with employes as they have done in past years, announcements are being made almost daily in regard to the division of profits with employes and of other methods beside the payment of wages of recognizing valuable services. One plan which is growing in popularity is the insurance of lives of employes. For example, the Galion Iron Works & Mfg. Co., Galion, O., manufacturer of culvert pipe, roadmakers' machinery, contractors' and municipal supplies, gave every one of its employes from the president down a Christmas present of a life insurance policy issued by the Equitable Life Assurance Society, which guarantees that in the event of the death from any cause it will pay the salaries of such employes to their families each month for an entire year. D. C. Boyd, president and general manager of the company, said in regard to this plan:

"We regard everyone in our service as an important integral part of our company and of distinct value in carrying our purposes into effect. The officers of the company have the keenest interest in the welfare of each individual connected with us and have taken every possible precaution to surround all with the most modern equipment for their safety and comfort. We known of no other way in which we could more efficiently manifest our concern for our employes than through the protection of their families and it is our hope that these life insurance policies will add something to their feeling of security."

Unexpected Events

The action of the Pennsylvania Co., the parent company of the Pennsylvania Lines West of Pittsburgh, in declaring a dividend of 1 per cent, making 4 per cent for the year, a reduction of 3 per cent as compared with previous years, came as a distinct disappointment to the business world. In announcing the action, the directors stated that "the reduction was due chiefly to the large decrease in traffic and a material reduction in the revenue on the lines west of Pittsburgh." On the other hand, the declaration of the regular dividend by the New York Central had a good effect. In spite of the dullness on the stock exchange last week, the railroad rate decision has had favorable effect. It is believed that one of the principal results will be to discourage foreign investors from selling American railroad securities.

Will Increase Capital

The Turnbull Wagon Co., Defiance, O., is about to increase its capital stock $100,000, making a total of $400,000. The company has just closed its most successful year since 1906 and the new capital will be used in developing the business, erecting additional buildings, purchasing new machinery, etc. About a year ago, the personnel of the company underwent a complete change. J. B. Merrell, of the Merrell Co., Toledo, was elected president, and A. J. Colt, of Moline, Ill., secretary and manager.

The Cleveland Crane Plan

Employes of the Cleveland Crane & Engineering Co., of Wickliffe, O., have received checks from the company representing a share of the profits of the year distributed as a bonus for faithful service. This bonus system has been in vogue with the company about five years. It is figured on the percentage basis. Under this system, 3,000 hours are taken as a year's work and to each employe who is not absent from work more than one day of each month during the year, 1 per cent of his yearly wages is paid for each full year that he has been in the employ of the company. A man who has been with the company five years thus receives 5 per cent of his yearly wages.

The mutual benefits of the system for both employer and employe, officers of the company say, are inestimable. The majority of the employes were eligible for benefits this year.

British Profits

Earnings of the leading British steel firms, as disclosed by their latest reports, are interesting. Some held their annual meetings before the war took place, while, in other cases, the returns did not include the war period. The great firm of Vickers, Ltd., made a record profit of £900,000 and distributed a dividend of 12½ per cent, at the same time issuing new share capital to the extent of £1,000,000. Guest, Keen & Nettlefold made a profit of £400,000 and distributed in dividend and bonus 15 per cent while largely increasing reserves. Armament companies generally did well; the Birmingham Small Arms made a profit of £190,000, a substantial increase on the year, and distributed 15 per cent. Baldwins, Ltd., well in the front rank of British steelmakers, made a profit of £209,000 and distributed 10 per cent, carrying forward a substantial balance. The Palmer

Ship Building & Iron Co. made a profit of £96,000, or nearly treble that of the previous year, but decided not to distribute a dividend. Bolckow, Vaughan & Co., after making very large extensions, had a profit of £246,000 and paid 6 per cent dividend. Staveley Coal & Iron Co. paid 12½ per cent, a substantial reduction on the previous year, as the result of a conservative policy, adopted in view of the war. Cammell, Laird & Co. made a profit of £174,000, an increase of £30,000, but paid only 2½ per cent dividend. Apparently, the firm has a number of arrears on preference shares to pay off. Armstrong, Whitworth & Co. paid 12½ per cent dividend to their ordinary shareholders, notwithstanding large extensions of plant carried out during the year. John Lysaght & Co. made a profit of £330,000 and paid a dividend of 10 per cent on ordinary shares with a 15 per cent bonus. Owing to the very large carry-forward last year, they are able to do this, and still carry forward £478,000. Large extensions have been made during the year.

Messrs. Pease & Partners made a profit of £386,000 and paid 12 per cent dividend, but many of the shareholders clamored for more, declaring that the earnings of the company justified a 25 per cent dividend. John Brown & Co. were able to meet their shareholders with a balance sheet claimed to be the best in the history of the company, showing a balance for division of £467,000, on which they paid 10 per cent to ordinary shareholders and carried forward £97,000. The Frodair Iron & Steel Co., among the smaller companies, made a net profit of £11,800 and distributed 10 per cent. Dorman, Long & Co. realized £258,000, an improvement on the year of £25,000, and paid a dividend of 6 per cent. It was explained that very large sums had been spent on extensions. The South Durham Steel & Iron Co. made a profit of £302,000 and paid 25 per cent for the year. The Metropolitan Carriage & Wagon Co., which includes some large Midland steel works, had a divisable amount of £469,000 and paid dividend and bonus of 15 per cent and placed £124,000 to reserve, carrying forward £118,000. A large number of the smaller companies have done extremely well, and probably it will be found that even the war will not seriously disconcert them during the coming year.

Financial Notes

The Youngstown Sheet & Tube Co., Youngstown, O., has declared the regular quarterly dividend of 1¼ per cent on the preferred stock and a dividend of 2 per cent on the common, both payable Jan. 1 to stockholders of record Dec. 15.

The Dominion Bridge Co.'s profits for the year were $629,968. A contract has been closed for the manufacture of shells for the war office.

Manning, Maxwell & Moore have declared the regular quarterly dividend of 1½ per cent, payable Dec. 30 to stock of record that date.

The West Steel Casting Co., Cleveland, has had the annual profit-sharing distribution to its 50 employes this year. The profits distributed to employes were about 10 per cent of the yearly earnings of the men.

Directors of the Chandler Motor Car Co., Cleveland, yesterday declared the regular quarterly dividend of 1¾ per cent on the preferred and an extra 2½ per cent on the common, payable Jan. 1, to stock of record Dec. 31. This makes 17½ per cent paid on the common stock in the calendar year 1914.

Petitions in bankruptcy were filed Monday by the Krit Motor Car Co. and Krit Sales Co., both of Detroit. The liabilities of the motor car company are said to be $881,233, with assets amounting to $622,533. The sales company liabilities are, according to the petition, $234,305 and the assets $256,814.

Profits for the Ford Motor Co., Ltd., of Walkerville, Canada, according to the annual statement for the year ended Oct. 31, 1914, and made public yesterday, totaled $2,022,496,06; nearly 200 per cent of capital stock, with $1,924,747.04 accredited to the home office and $97,749.02 to the company's branches.

A petition in bankruptcy was filed in the United States district court Thursday against the International Power Co., which was put in the hands of a receiver in an equity proceeding in the court of chancery at Trenton, N. J., recently. The probable assets stated in the petition are $200,000. The liabilities are not estimated.

The income statement of the Willys-Overland Co., Toledo, for the year ending June 30 shows earnings equivalent to 24.4 per cent on the common stock, after transferring $300,000 to contingent reserve and paying 7 per cent on the reserve stock. Dividends on the common stock were 11 per cent for the year.

Charles A. Terry, Walter D. Uptegraff and H. H. Westinghouse, executors for the estate of George Westinghouse, have contracted to sell their stock in the Westinghouse Machine Co. to the Westinghouse Electric & Mfg. Co., on the basis of three shares of Machine stock for one share of Electric stock. Mr. Westinghouse controlled the former company, a $10,000,000 corporation, but the other stockholders will be allowed to share in the sale agreement.

The Chickasaw Iron Works, Memphis, Tenn., has been reorganized, with the following officers and directors: Joseph L. Dolan, president and general manager; Harlow Bennett, vice president; Mrs. Elizabeth Randle, chairman of the board of directors; R. McFarquhar, secretary and manager credit department; E. T. Lesley, treasurer and manager structural department, and Israel Peres, counsel. The directors are: Mrs. Elizabeth Randle, Joseph E. Dolan, Harlow Bennett, R. McFarquhar, E. T. Lesley, Mrs. Sarah M. Clarke and Israel Peres.

New Erie Consolidation

The Erie Pump & Engine Works, Erie, Pa., maker of sand and gravel dredging pumps and general contractors' pumps, recently was consolidated with the Northern Equipment Co., also of Erie, which manufactures boiler feed water regulators and governors. The name of the new concern is the Erie Pump & Equipment Co., and it will occupy the property of the Erie Pump & Engine Works. John G. Pfadt, who was president of the Erie Pump & Engine Works, is not connected with the new concern. John H. Dougherty, who for a number of years has been in the employ of the Jeansville Iron Works as designer of centrifugal pumps, has been engaged to take charge of the designing of pumps for the new company. The officers of the Erie Pump & Equipment Co. are: E. W. Nick, president and treasurer; D. H. DuMond, vice president; V. V. Veenschoten, secretary.

Foundrymen Will Meet

New York, Dec. 29.—The Associated Foundrymen of New York and vicinity will hold their first meeting of the new year on Jan. 2, 7:30 p. m., at the Hotel Chelsea, West Twenty-third street, New York City. The speaker will be James Wood Pogue, of the Sheldon School, New York, whose subject will be "The Science of Business Success."

According to a letter received in this country from Monsieur Christianes, who signs himself as "commercial agent" with address at 7 Square Naveau, Paris, the latter is desirous of getting in touch with firms wishing to establish sales agencies in France for automobiles and various classes of machinery. The letter states that adequate references can be furnished.

An Answer to a Big Question

"Where Are the Future Leaders of the Steel Industry to Come From?" Asked a Prominent Steel Man—Read the Reply Below

BY C J STARK

THE postmaster of South Bethlehem, Pa., scratched his head in perplexity when a letter addressed in the following disjointed fashion recently came to his attention:

MR. EGG RACE,
South Bethlehem, Pa.

But his puzzled state of mind was only momentary. The name of Eugene G. Grace, president of the Bethlehem Steel Co., is too well known to the general population of the eastern Pennsylvania mill town to occasion much doubt as to the real though poorly expressed intentions of the correspondent. In the same way that the Bethlehem steel works is the surmounting factor in the daily business movements of the town, so Mr. Grace and his associates from Mr. Schwab down, occupy a most prominent position upon its purely personal side. Few are the citizens of the two Bethlehems—South Bethlehem and Bethlehem—who do not pride themselves on at least a speaking acquaintance with the men who have developed so extensively within the past 10 years the great industry from which the community constantly derives an intense and justified gratification.

But Mr. Grace's acquaintance and activities are not confined to the limits of his home town. As the youngest president of a large steel company in the United States, he enjoys a prominent and favorable position throughout the entire steel trade. He is looked upon as one of the leading members of that coterie of younger steel men who are beginning to make their influence felt in the broadest channels of the industry. Mr. Grace has just passed his thirty-eighth birthday. In a $63,000,000 corporation employing in normal times 13,000 to 16,000 men, he holds the highest executive position next to Mr. Schwab, who occupies the post of president of the Bethlehem Steel Corporation, the parent organization, and chairman of the Bethlehem Steel Co. Sometimes the remark is heard that the steel industry of the United States is suffering from over-organization; that the present-day regime of large combinations is not as conducive to the development of great steel makers as the good old days of merciless competition when the companies were smaller and more numerous and stood or fell in accordance with the skill of their officers to force a place for them in the battle of business wits. Those who voice such a theory have raised the question, whence will come the future Garys, Schwabs, Farrells, Kings, Toppings and other leading figures of the industry of today?

Mr. Grace is one of that group of younger men who now are framing the answer to this question.

Not long since a party of prominent steel men turned their conversation to this personal phase of the steel business. One of their number remarked he was at a loss to know where would be found a capable successor of a certain executive now in the fullness of his power and exercising a broad influence in shaping the ways of the whole steel industry of the United States.

"I've got in mind right now a man who can fill the bill," replied the head of a large company who is widely noted for his achievements as a steelmaker and as a builder of successful business organizations, "he is connected with the Bethlehem Steel Co. and his name is Grace." No higher tribute to the ability of Mr. Grace could have been paid by one worthy to judge.

EUGENE G. GRACE,
President, Bethlehem Steel Company

The Bethlehem Steel Corporation embraces not only the Bethlehem Steel Co., but large ship building, mining and other manufacturing properties. It is known most widely, however, for the leading position which it occupies in the steel industry. Universal recognition is given to it in the trade as one of the most enterprising and resourceful companies engaged in the manufacture of steel today. It is a well-appreciated fact that no large company in this country has so diversified and specialized its finished product and its methods of manufacture as the Bethlehem Steel Co. Mr. Grace furnishes much of the executive direction peculiarly required for the management of so many-sided a business proposition. He is one of that vigorous group of men, some of them quite youthful, surrounding Mr. Schwab, who have extended the company's business to the four corners of the earth and have gained for South Bethlehem a real and permanent place upon the steel map. No other company in the United States, relatively, has been carrying on so extensive a scale of works improvements and enlargements in recent years as the Bethlehem Steel Co., and the development of this program of heavy expenditure and of engineering skill, largely has been in the personal charge of Mr. Grace and his assistants.

Mr. Grace is of the kind that whatever he does, he does well. He has been satisfied only with a position in the front rank ever since he first took up his drafting instruments as an aspiring novice in the engineering profession. At Lehigh University, where he graduated with the degree of electrical engineer, in 1899, he left a good record for scholarship for future generations of students to shoot

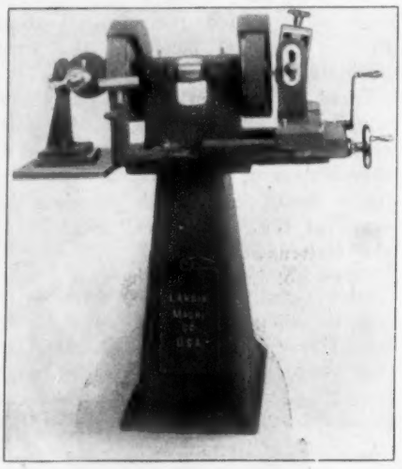
at. He won prizes in mathematics and in his sophomore year, he was awarded the Wilbur scholarship, the highest distinction in class work open to an undergraduate of the university. He also is a member of Tau Beta Pi the honorary engineering fraternity. He passed out of the halls of Lehigh University, which has given the steel industry so many eminent and capable technical experts, with the well-earned distinction of having been one of the best students that ever attended that institution.

As a steel man, Mr. Grace won his spurs amid the grime and smoke of the works. In this respect he has followed in the footsteps of Mr. Schwab, Mr. Farrell and other leaders of the industry. It required only 13 years for him to make the fight that carried him from the bottom to the top. On June 29, 1899, he entered the Bethlehem works as an ambitious young technical graduate. On April 1, 1912, at a meeting of the directors in New York, he was elected president of the Bethlehem Steel Co. at the age of 36. Between these two dates there was a record of demonstrated merit and progressive accomplishment. Three years after he had entered the company's employ, Mr. Grace had reached the position of superintendent of yards. On Feb. 21, 1906, he became assistant to the general superintendent, acting during part of 1905 as general superintendent of the Juragua Iron Co., the Cuban mining subsidiary of the steel company. He succeeded to the general superintendency of the steel works on June 27, 1906, when but 30 years of age. A little more than two years later, or on Oct. 22, 1908, he was made director and general manager of the company and his elevation to the presidency followed less than four years from that date.

To accost Mr. Grace is to appreciate some of the qualities that underlie his success. His is a personality that attracts and in addition there is about his well-knit figure that suggestion of vigorous intentness and reserve force that demonstrate alike youthfulness and thoroughness of character. His quick, direct manner of address and his keen searching glance carry the impression of solid assurance and of ripened experience, of lessons well mastered and capably applied. The spring and enthusiasm that one would associate with his years and look for, all are there. In everyday parlance, Mr. Grace has the "punch".

The Bethlehem Steel Co. rightly has been noted for the care it has given to the cultivation of flower beds, lawns and to other efforts to give its mill yards a touch of beauty and of order. A recent visitor at the works, agreeably surprised at the sight of the flower beds and of the other signs of well-kept grounds, jokingly inquired of Mr. Grace whether the company was engaged in making steel or in raising flowers. The answer he received was characteristic: "We primarily are engaged in making steel but we make better steel and more of it by also raising flowers and having them in our yards." To know Mr. Grace is to expect an answer like this. There is much of the humane idealism of youth in it perhaps, but also there is represented the practical insight of a large employer into the finer sensibilities of men, which when well applied usually pays richly in dividends of contentment and inspiration.

Mr. Grace was born in Goshen, N. J., Aug. 27, 1876. Before matriculating at Lehigh University, he prepared at Pennington seminary. His present residence is in Bethlehem.



DUPLEX LANDIS CHASER GRINDER

G. Muntz, vice president and general manager of the Tropenas Converter Co., 50 Church street, New York City, is representing a firm in France that is desirous of representing American manufacturers of machine tools, rolling mill and forging machinery in that country. During the past 30 years this company represented 23 German manufacturers and last year handled approximately $200,000 worth of German machinery. However, since the war, shipments of German machinery have been entirely cut off.

The Chicago office of A. Milne & Co., New York City, steel and iron merchants and importers of Swedish steel and iron, is now located at 550 Washington boulevard.

Landis Chaser Grinder

A chaser grinder designed to meet the requirements of users of thread cutting dies recently has been placed on the market by the Landis Machine Co., Waynesboro, Pa. As shown in the accompanying illustration, the machine is of a duplex nature in that it is fitted with an attachment for handling all sizes of chasers and also a device to sharpen the disc cutters of roller pipe cutting machines. In addition, it may be used to grind lathe, planer or shaper tools. The chaser grinding attachment has adjustment in both horizontal and vertical planes with suitable graduations for controlling the lead and rake angles on dies. Both the transverse and longitudinal feeds are in horizontal planes which is said to militate in favor of accurate grinding. The table is gibbed at both sides and is finished with an overhang to protect the guides from emery dust. The disc cutter grinding attachment is adjustable vertically and horizontally. It is operated by hand. An adjustment rest is provided to facilitate grinding miscellaneous tools.

Waterproofing Material

The use of iron cement, produced by the Smooth-On Mfg. Co., Jersey City, N. J., for repairing defects in castings, is too well known to require extended description. This compound, however, has many other applications and it is now put up in forms which make it particularly applicable for waterproofing, dustproofing and oilproofing concrete floors or for waterproofing stone walls, wooden tanks, roofs, pavements, etc. For these purposes, if desired, it may be mixed with Portland cement and sand, making what is said to be a thoroughly waterproof concrete. It is said that the material is absorbed into the concrete, combining with it mechanically and chemically, making it heavier, denser, harder and waterproof. When applied as a wearing surface on concrete floors, it metallizes sufficiently hard for light traffic in four days and for heavy traffic in ten days. A booklet recently has been issued by the Smooth-On Mfg. Co. giving detailed directions for using Smooth-On for the various purposes suggested above.

The Joseph Dixon Crucible Co., Jersey City, N. J., has issued a mailing card describing the features of Dixon boiler graphite, which is said to reduce fuel consumption, prevent the hardening of scale on flues and to give the surface of the boilers a smooth polish which militates against pitting and facilitates the removal of scale.

Mayari Ores in Blast Furnaces

An Account of the Difficulties Encountered in Mining This Cuban Ore and Preparing it for Blast Furnace Use—Results of Recent Tests

BY RICHARD V McKAY

HERMANN A. BRASSERT'S statement in his paper on American blast furnace practice published in THE IRON TRADE REVIEW, May 28, that, "with more and more difficult raw materials, progress is not always in the direction of new records of production and fuel consumption, but in the ability to maintain the best results of the past in the face of greater handicaps," has particular application to the progress made during the last six years in developing the practice of smelting the high aluminum Cuban ores in the blast furnace. The fundamental conditions have been somewhat different as between progress made in Mesabi versus that in Cuban ore practice. In the latter case, it has not been a struggle to retain ground already conquered. It has been one of aspiring to the high standards previously set by Mesabi practice. During the entire period, the Cuban ore furnaceman has been on the under side. He has been fighting to do as good work on these ores, which in their natural condition might be termed low grade, as had previously been done on Lake ores, without ever daring to think that he could surpass the results obtained in earlier practice. All the odds seemed against him.

Before proceeding with the more or less detailed account of the various steps in the march toward the latest very satisfactory results smelting Mayari ore, it might be interesting to picture some of the obstacles, some visible and some otherwise, which lay in the path of the metallurgist and engineer, when the Mayari ore fields were discovered in 1904.

The deposit was enormous in extent, but it was located some 2,000 feet above sea level on a plateau difficult of access, miles away from the sea coast, and hundreds of miles away from the blast furnaces which were to be supplied, in an almost uninhabited, insect and fever infested district. The problem of mining was simple, but the ore contained great quantities of moisture and combined water, which necessitated drying before being shipped to the States.

To erect and operate an industrial plant with all the requisite accessories for this purpose, in a country far from the labor and manufacturing markets, was not a very inviting task, yet in view of the freight saving on water, this seemed to be the only recourse. The ore was extremely fine, and naturally, since nodulizing was but one step further than drying, there seemed no reason why the two results could not be obtained in a single operation. Thus opened the immense field of nodulizing problems. Due to excessive moisture and, no doubt, partly to the high alumina content, Mayari ore was not as easily nodulized as other materials, such as Cornwall concentrates, pyrite cinder, flue dust, etc., upon which much experience had previously been gained.

Preliminary experiments were conducted with Mayari ore in a nodulizing kiln at the Lebanon plant of the Pennsylvania Steel Co. and they indicated that there was no apparent difficulty in forming nodules, neither was the fuel consumption considered excessive. However, when the somewhat larger kilns, designed for greater capacities, were placed in operation at Felton, Cuba, with the best labor available, which was none too good, it was discovered that many lessons were yet to be learned. Extensive me-

TABULATED RESULTS OF TEST RUN ON MAYARI ORE

		Mayari Ore					
	Dec., 1908 Lake ore.	75 per cent fine nods. and unwashed coke.	81.25 per cent fine nods. and unwashed coke.	Coarse nods. and washed coke.	3 per cent lime nods. and washed coke.	7-9 per cent lime nods. and washed coke.	Screened nod. and washed coke.
Product, tons	170.43	91.76	98.98	157.10	150.08	156.39	158.58
Actual yield	0.52	0.51	0.49	0.59	0.57	0.58	0.61
Theoretical yield	....	0.59	0.59	0.605	0.596	0.581	0.62
Fuel ratio	1.15	1.43	1.49	1.15	1.18	1.15	1.13
Stone, per cent of ore	....	0.46	0.46	0.35	0.33	0.30	0.38
Flue dirt per cent of ore	....	....	9	6	5.2	1.4	3.6
Blast temperature, degrees Fahr.	735	1,027	985	873	832	820	816
Blast pressure, pounds	10	8.5	10	8	8	7½	8
Cubic feet air per minute	21,504	16,212	18,122	20,482	20,580	20,580	20,580
Chromium in pig iron	....	2.09	2.28	2.08	2.07	2.14	2.29
Silicon in pig iron	....	1.48	1.40	1.06	1.01	1.07	1.24
Nickel in p g iron	....	0.95	1.04	1.24	1.19	1.07	1.19
Sulphur in pig iron	....	0.043	0.072	0.041	0.027	0.039	0.025
Sulphur in coke	....	1.07	1.30	0.77	0.81	0.80	0.87
Ash in coke	....	13.92	11.38	8.54	8.79	8.91	8.84
Sulphur in slag	....	2.60	2.31	1.82	1.97	1.97	2.04
SiO_2 + Al_2O_3 in slag	....	46.60	50.08	51.82	52.22	52.95	54.07
SiO_2 in slag	....	25.70	24.11	22.58	24.19	23.81	24.30
Al_2O_3 in slag	....	20.90	25.97	29.25	28.03	29.14	29.76
CaO + MgO in slag	....	49.76	.....	45.36	46.00	44.61	43.95
CaO in slag	....	40.10	.....	37.44	37.51	36.68	35.94
MgO in slag	....	9.66	.....	7.92	8.49	7.93	8.00
Ore on 10 mesh	....	.....	35.29	57.32	63.65	80.58	74.90
Ore through 40 mesh	....	.....	15.50	7.10	5.30	2.24	6.47
Flue dirt through No 10 on No. 20	....	.....	8.18	18.13	23.45	16.73	6.22
Flue dirt through No. 40	....	.....	60.75	28.83	19.77	22.09	36.61
Top pressure, inches water	....	.....	.....	1.2	1.25	1.14	1.17
Top temperature, degrees Fahr.	....	.....	.....	249	275	272	286
Moist. grains per cubic foot	....	2.7	3.5	2.5	4.0	3.6	4.7

Note:—In slag analyses, the per cent of CaO shown is slightly in error insofar as it includes the Ca as CaO which is combined with the S. to form CaS.

A discussion of Hermann A. Brassert's paper on American Blast Furnace Practice, contributed to the proceedings of the 1914 spring meeting of the American Iron and Steel Institute by Richard V. McKay, of the Pennsylvania Steel Co.

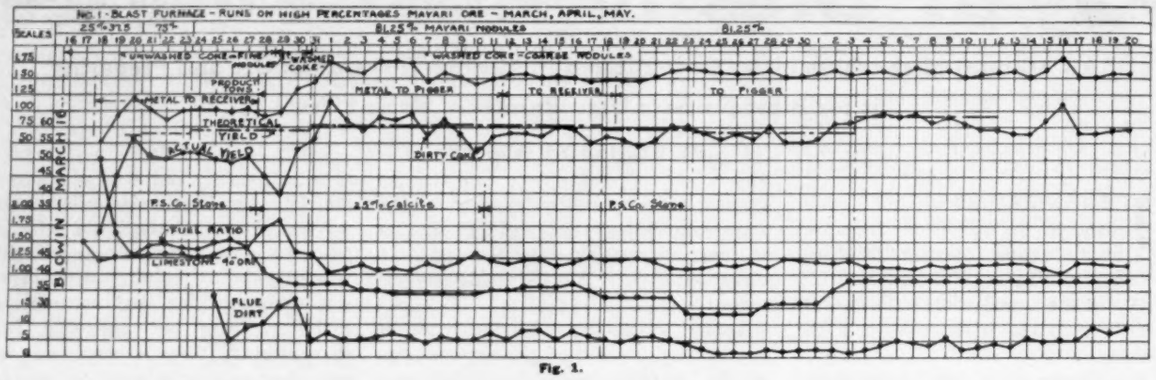


Fig. 1.

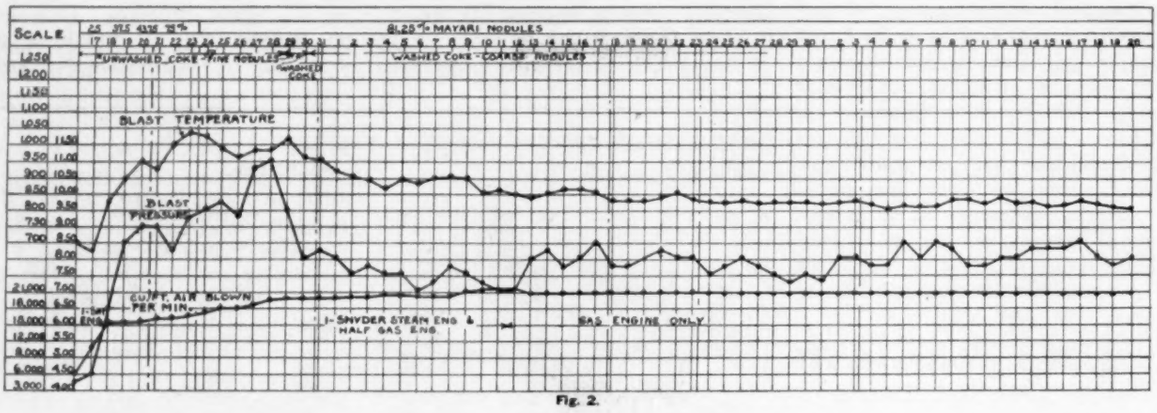


Fig. 2.

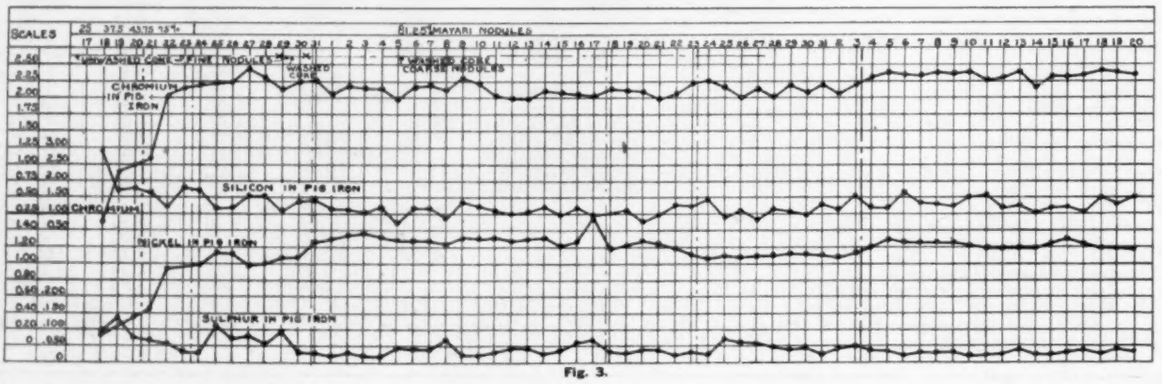


Fig. 3.

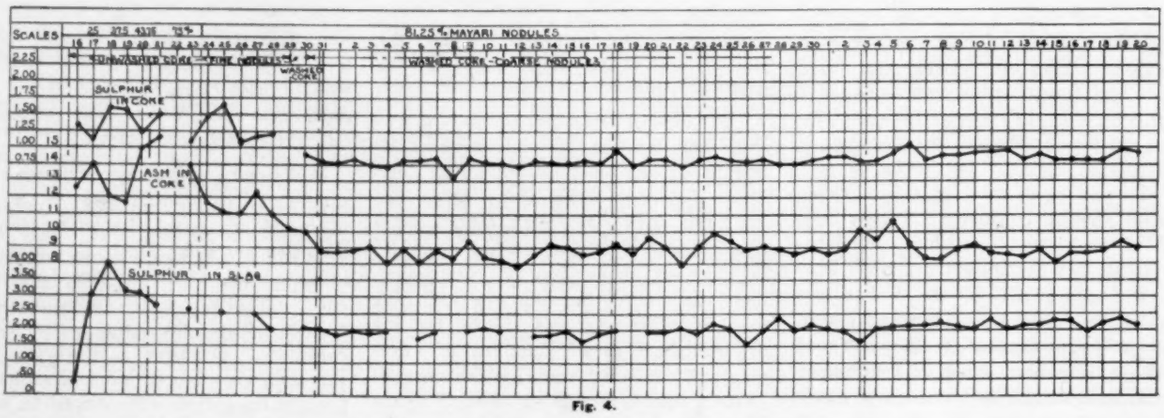


Fig. 4.

FIG. 1—CURVES SHOWING YIELD, FUEL RATIO, LIMESTONE RATIO, ETC.
FIG. 2—TEMPERATURE AND PRESSURE CURVES, NO. 1 BLAST FURNACE RUNS ON HIGH PERCENTAGE MAYARI ORE
FIG. 3—CHROMIUM, NICKEL SILICON AND SULPHUR CURVES
FIG. 4—COKE DATA FROM RUN ON HIGH PERCENTAGE MAYARI ORE

chanical changes were necessary to adapt the plant to tropical conditions. Machinery which was at all complicated, or which necessitated intelligence in operation had to be eliminated as far as possible, for the Cuban and imported labor proved quite unreliable. Besides this, Mayari ore in the raw state was handled with great difficulty, due to its sticky, clayey consistency, and the original bucket elevators and conveyors gave way to the gantry cranes and grab buckets. In the raw state, the ore would stand in a pile at a ninety degree angle, and even when grab buckets were installed, the question of handling was not entirely solved. This same natural condition of the ore gave no end of trouble in obtaining regular feed to the kilns. Various constant feed devices were tried out, until the present revolving platform feed was settled upon as the best to meet the conditions. Had the plant been located within easy reach of a manufacturing center, all of these difficulties could have been corrected within a short period of time and at fairly small expense, but since it was necessary to build all machinery in the States and ship it to Cuba, months were consumed, where under similar conditions in industrial plants more favorably located, it would have been a matter of days.

Attempts to Nodulize.

From the first, the fuel consumption nodulizing Mayari ore and the quality of nodules as far as fines were concerned was a matter of considerable disappointment, although it was expected that slightly more fuel would be needed than experience with other materials had established. The question of obtaining complete combustion, together with that of transmitting the heat generated most effectively to the ore, the diminution of heat losses, recovery of lost heat, experiments to facilitate nodulizing and increase the size of nodules by additions of foreign substances by reducing the melting point and otherwise all constitute but a part of the items which have been consuming the time and thought of the metallurgist.

Concerning the quality of nodules produced, it was assumed at an early date that 90 per cent remaining on a 40 mesh screen should be satisfactory for blast furnace use. This size was assumed with Lake practice as a basis, the idea being to get ore somewhat coarser than the Mesabi.

With this standard set, operations at the Felton plant were brought to a fairly satisfactory basis. Kiln tonnages were increased gradually to a maximum of nine tons per hour and fuel consumption was reduced at the same time, However, the quality of ore produced gave excessive flue dirt losses in the blast furnace, and it was found necessary to make a new standard of 75 per cent material remaining on 10 mesh screen. This more recent standard resulted in reducing the kiln tonnages and increasing the fuel consumption, but by using binders in the nodulizing process satisfactory results have been obtained. Since successful blast furnace practice demands the coarser nodules, it will be upon this basis that the future advances will be made in Cuba.

Test Runs With High Alumina.

Following the nodulizing problems came those of the blast furnace. Uncertainty centered about the behavior of a furnace carrying such high percentages of alumina in the slag. There was no precedent to guide the furnaceman and naturally he had to be extremely cautious. In September and October, 1904, experiments were conducted on a small furnace at the Steelton plant of the Pennsylvania Steel Co. to determine some facts concerning this important question. By means of Lake ore, chromite, brick bats, and bauxite, a furnace mixture was concocted approximating Mayari ore in chemical composition. The test run lasted 11 days during which time the furnace averaged 102 tons on a one to one fuel ratio. This mixture worked with sufficient success as to the character of slag and general furnace conditions, to warrant a small shipment of ore from the mountains in the Mayari district. About 1,200 tons were transported on mule back from the deposit at El Perio to the sea coast, and shipped to Steelton, where it was tried with more or less success on No. 1 furnace in February, 1906.

This test was of six days duration, the furnace averaging 59.5 tons of iron per day on a fuel ratio of 2.13. The flue dirt were excessive, however, and as a result the actual yield of pig iron was but 29 per cent.

Notwithstanding the unfavorable results as to fuel ratio and yield, the fact was established that the alumina content of the ore presented no insurmountable difficulties but it was conceded that the physical condition of the ore would require considerable attention. Further shipments of raw ore, and later nodules, were made to the States and converted into iron from which the steel maker had an opportunity to determine his skill in the elimination of chromium. Suffice it to say that the troubles of the open hearth and bessemer men were many, but this phase of the Mayari problem was worked out economically in advance of the blast furnace difficulties.

Unlike the conditions which surrounded the development of Mesabi practice, experimentation on the Mayari ores was confined to the resources and equipment of one company with coke, generally speaking of an inferior quality and a limited corps of furnace operators.

Before proceeding further, it might be well to describe in a general way this ore which has recently become such an important factor in the iron ore resources available to the steel industry of the eastern United States. The enormous deposits in northeastern Cuba can be mined at a cost which can only be duplicated elsewhere under exceptional circumstances. The heavy mantle of bessemer grade ore ranging in thickness from one foot to eighty feet, averaging about 18 feet, with absolutely no over burden, covers a plateau of serpentine bed rock. From this it derived its origin through a process of rock-disintegration and decay.

It consists of a mixture of hydrated iron oxide, limonite, with hydrated aluminum oxide, bauxite, and the oxides of nickel, chromium, and cobalt. In appearance the ore is a reddish yellow to dark red in color, and is of a decidedly clayey consistency.

It is true that experience with Mesabi ores served as a precedent and demonstrated that it was possible to smelt very fine ores economically in a blast furnace, but perhaps this fact misled rather than guided those who were working to solve the mysteries of Mayari ore. As a consequence, much valuable time was consumed in trying to make a furnace digest the raw ore with its 20 to 25 per cent hydroscopic moisture and 11 to 13 per cent combined water. However, to counteract this tendency, the desire to save freight charges on shipments of useless water from Cuba to the States immediately suggested the use of some type of dryer. Then too, although furnaces were operated on high percentages of the raw ore, the excessive losses of iron bearing material as flue dust, the consequent low yield of iron and nickel, the uneven working of the furnace caused by slips and explosions, made the process uneconomical and indicated at an early stage that some method of preliminary treatment must be resorted to in order to agglomerate the ore and make it suitable for the blast furnace.

Raw Ore Unsatisfactory.

With large percentages of raw Mayari ore in a furnace mixture, violent slips occurred and made operations extremely irregular. Why this ore should act worse than Mesabi ores in this respect in passing through the furnace has been a question to which furnacemen have given a great deal of thought. Perhaps the most logical explanation is that the 11 to 13 per cent of combined water caused the trouble. No doubt, following a period during which the furnace was hanging, the stock was precipitated into the lower zones where the temperature

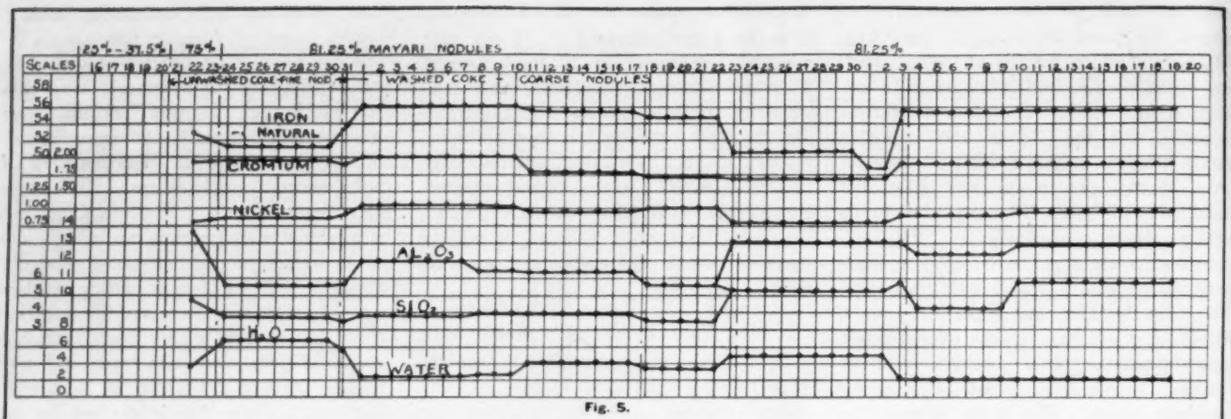


Fig. 5.

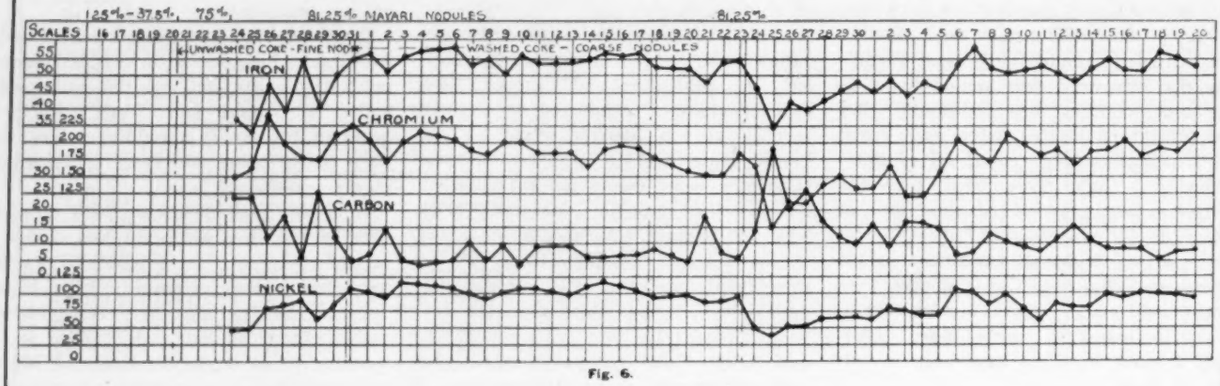


Fig. 6.

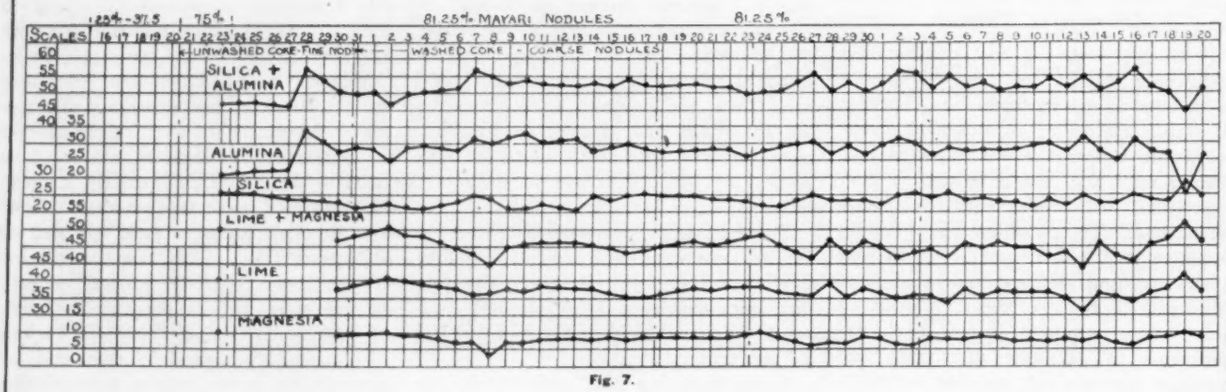


Fig. 7.

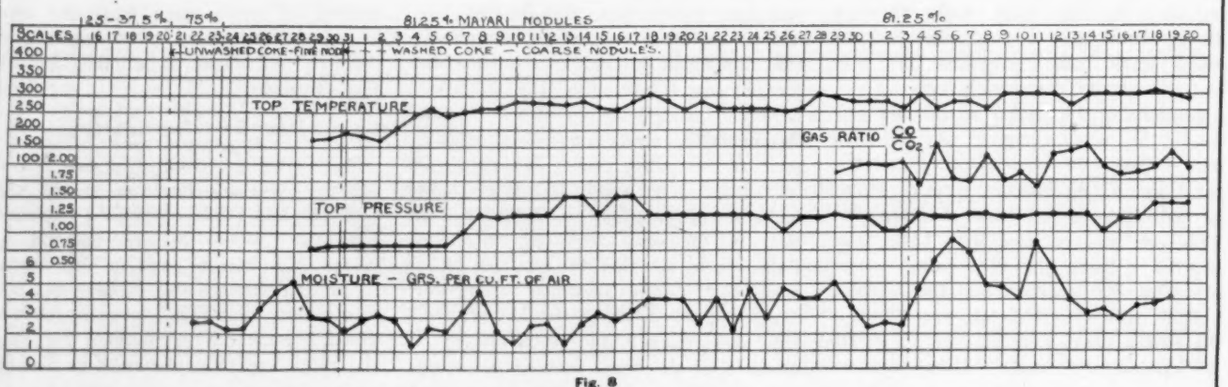


Fig. 8

FIG. 5—ANALYSES OF MAYARI NODULES
FIG. 6—ANALYSES OF FLUE DUST TAKEN FROM TEST RUN
FIG. 7—ANALYSES OF THE SLAG
FIG. 8—TEMPERATURES, PRESSURES, MOISTURE, ETC.

was great enough to drive off the combined water. The sudden generation of steam caused an explosion which gave the typical fine ore slip. These did considerable damage to the old fashioned open top furnaces, both at Sparrow's Point and Steelton, especially at the former plant where more experimenting was done on the larger capacity furnaces.

Nodulizing.

At an early date considerable preliminary experimenting was done to determine the most feasible means of preparing the ore. The use of briquetted raw ore lost favor, chiefly on account of mechanical difficulties and cost of production. A machine was built for the purpose of rolling the ore into corrugated sheets which were afterward sintered. This likewise proved expensive and did not bring the answer. Finally nodulizing was determined upon as the most promising method, and the erection of a plant was begun in Cuba. The fact that the Pennsylvania Steel Co. already had nodulizing kilns in successful operation at Steelton and Lebanon on Cornwall concentrates, pyrite cinder, flue dust, etc., no doubt encouraged the use of the kiln.

The first kiln went into commission November, 1909, and the first shipment of nodules was made in December of that year. At present, the plant consists of twelve kilns; eleven of which are 10 feet, shell diameter and 125 feet long, and one, 9 feet shell diameter and 125 feet long, with a daily capacity of 1,500 to 2,000 tons of nodules. Numerous modifications of this process have been developed which show good effects. An analysis of dried nodulized Mayari ore is as follows: Iron, 56.53 per cent; water 2.14 per cent; silicon, 4.11 per cent; alumina, 12.89 per cent; manganese 0.71 per cent; phosphorus, 0.018 per cent; chromium, 2.04 per cent; nickel 0.93 per cent and no sulphur.

As mined the ore has approximately the following composition:

	Per cent.
Fe	38.14
H_2O	23.22
SiO_2	2.00
Al_2O_3	10.00
Mn	0.51
P	0.013
S	0.15
Cr	1.46
Ni	0.57
Combined water	11.50

The question arises as to why flue dust loss with fine Mayari nodules is so much greater than with the relatively finer Lake ores. This is probably explained by the fact that the nodule particles are more free and granular than in the Lake ores and no doubt they retain this condition to a greater depth in the furnace, due to the absence of any great amount of carbon deposit in the upper zones of the furnace. From laboratory experiments made by passing blast furnace gas over samples of Mayari nodules and Admiral Lake ore under identical conditions of temperature, there was a maximum carbon deposit of 157 per cent at 450 degrees Cent. with Admiral ore against a maximum carbon deposit of 0.7 per cent at the same temperature with Mayari nodules. This condition is perhaps somewhat modified in the blast furnace, yet it is possible that it affects the tendency of the two ores to pass off, in the gas as flue dust.

A considerable tonnage of Mayari ore in the natural state has been sintered in Greenawalt pans by admixture of furnace flue dust which furnished the combustible material, but up to the present time, the sintering of this ore with the addition of coal, coke, or other straight fuel has only been conducted on an experimental basis. Mixtures of anywhere from one fourth flue dust, 15 to 18 per cent carbon, with three fourths raw ore, down to three fourths flue dust with one fourth raw ore have given good results. Eight to ten per cent of fine anthracite coal, culm or coke breeze mixed with the ore gave a good sinter when tried experimentally. Bituminous coal did not work satisfactorily as the hydro-carbons, tar, etc., volatilized from the coal in the burning portion of the charge condensed in the pores of the cold and wet portions, thereby closing up the air passages and causing dead unsintered spots. The sintering process promises to prove to be the most efficient means of preparing Mayari ore for the furnace.

Attention has been paid to application of the Mashek briquetting machine to the treatment of raw Mayari ore. This machine in its present form consists essentially of two corrugated rolls, with the corrugations on the surface, running parallel to the axis of the rolls. These rolls are held together by powerful springs which serve to exert pressure on the ore as it is fed between them, pencils of compressed ore approximately 12 inches long and 1¼ inches in diameter result, and it is hoped that these will hold together till they pass down into the furnace, or if they do break will not produce fines. Of course this material will not stand weathering and consequently will have to be charged directly from the machine into the furnace. Since the cost of mining of Mayari ore is so exceedingly low, any means by which the ore may be successfully prepared for use in its natural state is sure to prove attractive, more particularly as it may be found that the ore in its natural condition is best suited for reduction in a blast furnace.

To my mind, the inferior coke heretofore available in carrying on the furnace operations has proven to be the greatest stumbling block in the way of satisfactory progress, sharing in importance the question of size of nodules. The Maryland Steel Co. was forced to use in its furnaces, coke from an obsolete by-product coke plant, one of the first of its kind built in this country.

At Steelton, oven operating conditions were what could be expected with a modern Semet-Solvay coke plant, but the character of coal supplied to the ovens resulted in a coke of varying ash and sulphur content. The physical structure was weakened by layers of slate forming fracture planes, and this resulted in excessive quantities of coke breeze.

Troubles With Coke

As a consequence of the use of raw coke and coke containing worthless breeze, exceedingly high blast pressures resulted. Coke dirt scaffolds formed, and then at intervals would slide in great masses into the furnace hearth. The furnace required continual checking to prevent heavy slips. When the already fine state of the stock column due to the coke, was further aggravated by the use of fine Mayari nodules, the furnace conditions would grow worse. Under the circumstances, it was perhaps only natural that an undue share of the furnace troubles was attributed to Mayari ore. In other words, the extremely fine condition of the stock column due to both fine dirty coke and fine Mayari nodules has been the cause of high pressures, loss of tonnage, increased fuel consumption and practically all the other bad effects which were experienced on high percentage Mayari mixtures.

Certain developments of the last few months have cleared the horizon both at Sparrow's Point and at Steelton. Due to business conditions, all furnace operations were suspended at the former plant in January, 1914, and at that time also the old coke plant passed out, and has been dismantled. Operations were resumed in March using a high grade Connellsville coke. Since then, normal pressures, exceptionally good fuel consumptions and tonnages, and ideal furnace operations have been the rule.

Following are some records of No. 2 furnace, Maryland Steel Co., under both conditions—with old by-product coke and with Connellsville coke:

	Average daily tonnage.	Average daily fuel ratio.
Old coke:—		
September, 1913	316	1.18
October, 1913	329	1.14
November, 1913	302	1.13
Connellsville coke:—		
March, 1914	337	1.22
April, 1914	427	1.01
May, 1914 (14 days)	436	0.98

Much of the good record of April and May, 1914, is no doubt attributable to the use of coarser nodules than had previously been used. That the size of the nodules is an item of great importance is borne out by practice on 100

per cent nodulized Cornwall concentrates at Lebanon. On this ore of a character entirely different from Mayari, it is an established rule that fine nodules result in retarding the traveling of the furnace, in abnormal blast pressures and in reduced outputs of iron.

During this same period, at Steelton, a coal washing plant was completed for the purpose of removing slate and sulphur from the coking coal. This plant began operations in March, 1914, and at once the quality of coal resulting was such as to give an excellent coke in the ovens. The washing plant has a capacity of approximately 1,500 tons washed coal in ten hours.

The coke resulting from washed coal was of exceptional character physically as well as chemically, being strong and tough with a splendid open cell structure. Following are results of some physical tests made on washed and unwashed coke, showing slight decrease in specific gravity and correspondingly slight increase in size of cells, due to washing coal:

	Unwashed coke.	Washed coke.
Specific gravity apparent...	0.972	0.935
Specific gravity real.....	1.812	1.798
Per cent cells.....	46.96	48.31
Per cent walls.....	53.04	51.69

The Penn-Mary coals are naturally good coking coals and make splendid coke when the sulphur and ash are within reasonable bounds. This is no doubt the reason that such a slight difference is noted between the washed and unwashed coals.

A local dolometic limestone, which for Lake ore practice would be considered of a very low grade, suits the Mayari practice splendidly at Steelton. It analyses approximately 3.5 to 6 per cent SiO_2, 69.5 per cent $CaCo_3$ and 25 per cent $MgCo_3$. In Cuban ore practice it has been found that 9 to 10 per cent MgO in the slag is very beneficial. At Sparrow's Point a mixture of half calcite and half dolomite is used to obtain this condition. When calcite alone was used, trouble was experienced with foamy cinder and heavy slag runners. All stone is crushed to go through a six-inch ring, and the fines are removed.

With ideal coke available, and with a new standard established for the coarseness of Mayari nodules, a splendid opportunity presented itself for the settlement of some of the points about which questions seemed to exist. By eliminating all the variables possible, the field was opened for study of slag conditions, internal working of furnace and other items which might be demonstrated. With this object in view, an elaborate series of tests was begun in March, 1914, on No. 1 furnace at Steelton.

Tests at Steelton

This furnace is small, being 9 feet 6 inches hearth, 15 feet bosh, 11 feet stockline and 65 feet high, yet for experimental work it presented decided advantages. Tests of longer duration could be run on smaller tonnages of materials, and since most of the ore was especially prepared, this was quite a considerable item. It might be argued that results attained on this small furnace would not be comparable with those to be expected on a larger furnace. To meet this argument, we have previous history giving comparative performances of this small furnace and larger ones on other mixtures with conditions approximately alike. From earlier experience, it is fair to assume that this small furnace will run from 200 to 250 pounds higher on fuel consumption than one of the 300 ton furnaces. This is due chiefly to small size and uneconomical lines, and partly to the fact that the capacity is limited by lack of stove capacity and to the antiquated methods of filling. On the other hand, the flue dirt production would be but half that of a 300-ton furnace.

After blowing in on March 16, 1914, the furnace became fairly well straightened out on March 21 when, with unwashed coke, 75 per cent fine Mayari nodules was put on the furnace for two days. Then the schedule of tests continued as follows: Two days run on unwashed coke, 75 per cent fine Mayari nodules; five days run, unwashed coke, 81.25 per cent fine Mayari nodules; seventeen days run, washed coke, 81.25 per cent coarse Mayari nodules; six days run, washed coke, 3 per cent lime nodules; ten days run, washed coke, high lime nodules; and fourteen days run, washed coke, screened nodules. The results of these tests are given in the accompanying charts and table. Some points deserving special mention include the sudden clearing up of the entire situation when a change was made from unwashed coke and fine nodules, to washed coke and coarse nodules, with increased product, improved yield of iron from ore, drop in fuel ratio, drop in percentage of stone to ore, reduction in flue dirt produced, remarkable drop of 3 to 4 pounds in blast pressures, increase in nickel content of pig iron, drop in sulphur content of pig iron, and the establishment of extremely regular, uniform furnace conditions with complete absence of any slipping or hanging. The high alumina, and high percentage of acids in the slag may be of interest.

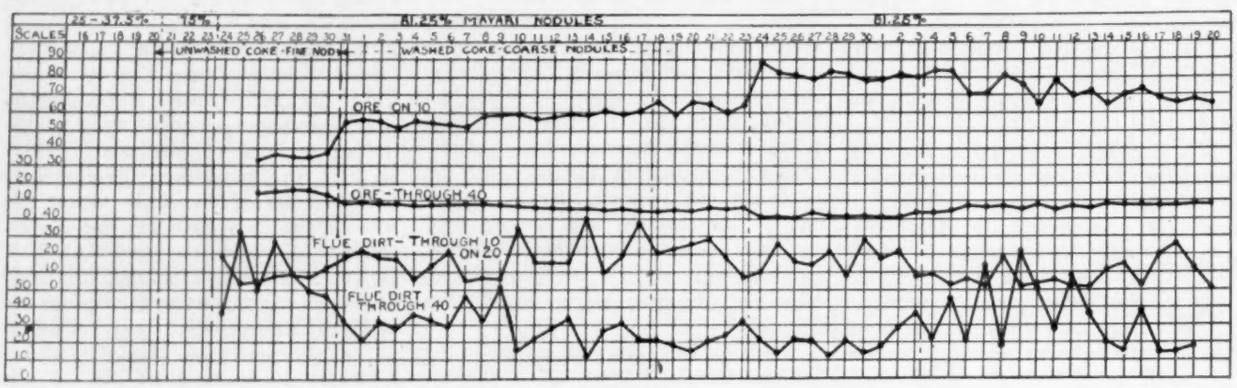


FIG. 9—SIZING TESTS ON NODULES AND FLUE DUST

During the entire run, the physical condition of the slag was excellent. After flushes and casts, the runners contained practically no cinder, all having drained clean. The slag was invariably hot and exceptionally fluid. With silica plus alumina about 52 per cent composed of approximately 29 per cent alumina and 23 per cent silica, good results were obtained. In fact it developed that variations in alumina from 27 to 33 per cent and in silica from 20 to 25 per cent had no apparent effect on the operation of the furnace. To me the matter of slag temperature appeared far more important than chemical composition. Our excellent coke gave an intensely hot hearth and no difficulty resulted in handling the slag and obtaining good iron.

A slag volume of approximately 1,740 pounds per ton of iron was maintained in the various tests. A small amount, 6 per cent of mill cinder running about

29 per cent SiO_2 seemed to help the slag conditions by increasing the SiO_2 about 2 per cent in the slag.

The normal Mayari pig iron presents very little grain in the fracture. This iron has as a rule a large crystalline structure somewhat similar to spiegel, although with higher silicon content and under conditions of slow cooling, it is not uncommon to find fractures exhibiting a full grain. However, the tendency of chromium in pig iron seems to be to drive the carbon into the combined form, thus giving the spiegel effect. One great peculiarity of this iron is its high total carbon, which in our recent tests averaged 4.65 per cent and the high ratio of combined to graphic carbon.

The results show very little if any advantage of lime nodules over straight Mayari nodules, but the chances are the advantages of the former would be brought out to a more marked degree in a larger furnace, where the stock column is larger and consequently where more benefit would be derived from having the lime thoroughly mixed throughout the ore charge.

A summary of the average results from each test are tabulated herewith, together with the data on the month of December, 1908, when No. 1 furnace made a record tonnage on a mixture of 75 per cent Lake ore and 25 per cent Daiquiri ore.

RESULTS OF TEST ON LARGE FURNACE

Date.	Per cent Mayari in mix.	Tonnage.	Fuel ratio.	Yield.	Tons Flue D.	Blast press.	Average—24 hours Pig iron Si.	S.	Cr.	Ni.
April 13, 1914..	57.2	453	1.02	0.58	92	15.75	1.05	0.025	1.35	0.73
April 14, 1914..	56.4	404	1.12	0.52	111	16.00	0.97	0.034	1.67	0.96
April 15, 1914..	61.2	434	1.01	0.57	91	16.25	0.90	0.024	1.59	0.97
April 16, 1914..	62.4	410	1.06	0.56	67	15.5	0.91	0.026	1.70	0.96
April 17, 1914..	62.4	423	1.07	0.56	94	17.00	0.93	0.027	1.73	0.95
April 18, 1914..	61.0	448	1.01	0.58	69	16.50	0.71	0.035	1.66	0.89
April 19, 1914..	62.0	397	1.08	0.55	81	15.75	0.88	0.036	1.63	0.89
Average.....	60.4	424	1.05	0.56	86	16.50	0.91	0.029	1.62	0.91

In spite of the favorable results obtained on this small furnace the great question now is, "How will a large furnace work on similar mixtures?" The results will no doubt prove better on a large furnace. This point will be demonstrated at Sparrow's Point by a conclusive run in the near future as soon as the coarse nodules arrive from Cuba. Already a short test run was made on No. 1 furnace at Sparrow's Point, and the results were very encouraging. Tabulated data is presented herewith covering the seven days during which more than 50 per cent of coarse nodules was used in the mixture.

The nodules used for this short test were the same in size, as were used on No. 1 Steelton furnace test April 1 to 17 inclusive. They did not come up to the standard of 75 per cent on 10 mesh, falling as low as 57 per cent on 10 mesh, consequently the flue dirt produced was too high, averaging about 12 per cent of the ore charged. With standard large nodules, it is expected to keep the flue dirt down to 5 per cent of the ore charged.

With conditions relating to the quality of coke and the preparation of the ore, in such an unsettled state and demanding the undivided attention of everyone concerned, there was but little opportunity to experiment with any radical departures in furnace lines. The furnaces used for experimental work were the same ones called upon to turn out the regular grades of iron, so that with the limited facilities no changes could be made, even if desired, which would effect the furnace operations to a marked degree under anyone of these varied conditions.

At Steelton, the furnaces as at present lined have given fairly good results on Mayari ores, at least, as good as could be expected in the face of other difficulties.

As to the question of bosh angles, No. 1 furnace, Steelton, has 71 degrees, No. 2 furnace 76 degrees; No. 3 furnace 74 degrees; and the latest lined No. 4 furnace 77 degrees. With coke and ore troubles fast improving, we are inclined to favor the larger hearth, steeper and shorter bosh for Mayari ore practice, yet it is doubtful if the 80 degrees bosh furnace will work well on these more refractory ores. However, time and experience will, no doubt, prove the correctness of this statement. Up to the present, it can be stated as a fact, that practically no difference can be noted between the working of Mayari ore on a 74 degree bosh furnace as against that on a 76 degree bosh; therefore, I see no reason why even a steeper bosh should not work well.

Statistics of Mineral Production

The United States Geological Survey has issued an exhaustive report covering the mineral products of the United States for 1912 and 1913. Approximately 125 pages are devoted to a review of conditions and output in 1912 and 1913 by Edward W. Parker, acting chief of the department of mineral resources. Nearly 60 pages are given to a summary of the mineral production of the United States in 1913, compiled by W. T. Thom. This portion of the report contains a large number of valuable tables, including statistics covering the quantity and value of mineral products of the United States for 1880 to 1913, both inclusive. A large wall chart also has been prepared showing the mineral production in the United States from 1904 to 1913.

Magnetic Switch Booklet

A booklet entitled "The New Line of Cutler-Hammer Magnetic Switches" has just been printed for distribution by The Cutler-Hammer Mfg. Co., Milwaukee. The devices described in the booklet include a new magnetic lock-out switch of the series coil operated type, a redesigned line of shunt coil operated switches, and spring closed switches for dynamic brake service. The magnetic lock-out switches are for automatic motor starting purposes, the switches having the characteristic of remaining open when the current is excessive and closing when the current falls below a predetermined value. The redesigned shunt switches are now all of the clapper type construction and a fact emphasized in the booklet is that parts of shunt switches can be interchanged with those of the series coil operated lock-out switches of the same capacities. The spring closed switches also have the same contacts as the above types of switches. These switches are used in dynamic brake control systems in order to keep the dynamic brake circuit closed when the operator's master is in the off position, without the necessity of keeping a switch coil continuously energized. In case of failure of voltage this type of switch also insures keeping dynamic braking circuit closed.

Mine Hoist Equipment

The General Electric Co. has just issued an interesting bulletin, No. 48014, on mine hoist equipments. The bulletin is profusely illustrated, takes up the question of economy of electric drive, and treats of the general subject of underground hoists, their operation and control.

The Cincinnati office of the C. & C. Electric & Mfg. Co., Garwood, N. J., has been removed to 217 West Second street, that city. The office is in charge of F. A. Saylor. More space is available in the new location which will permit carrying a comparatively large stock.

Hardening Iron and Its Alloys

First of Two Articles Discussing Theories of Hardening in the Light of Recent Scientific Research

BY C A EDWARDS AND H C H CARPENTER

THE HARDENING of metals may, broadly speaking, be divided into two classes: First. that which is produced by direct mechanical work, such as hammering or rolling, and, second, that which is brought about when certain alloys are suddenly cooled by quenching in water from moderately high temperatures.

In regard to the hardening which is caused by rolling and hammering, at first sight it would seem that this is merely due to the mass becoming more compact and consequently less easy to penetrate or pull apart. Simple as this explanation is, modern research has conclusively proved that it is inadequate, though it certainly contains some truth. Another explanation is that the mechanical deformation produces smaller crystal grains, and the increased hardness is due to the crystalline fineness of structure. There is no disputing that the dimensions of the crystals are reduced in this way, but this fact alone can scarcely be regarded as a satisfactory scientific explanation of hardening phenomena, because there is no reason to suppose that by simply making the crystals smaller their individual hardness becomes greater. In other words, each perfect crystal unit must possess the same hardness whether it is a member of a small or large aggregate of similar units which have the same orientation. Hence the hardness which is associated with diminished size of crystals cannot be regarded as being directly caused by the crystals themselves; the effect must be caused by some substance or condition existing between the crystals.

As a result of many researches, Beilby has advanced a theory which is now generally accepted for the hardening of metals by cold-working. Most of the important experimental data and conclusions that were published in his papers were summarized in a lecture before the Institute of Metals, May 12, 1912. In that lecture Beilby said: "About 10 years ago the miscroscopic study of the structure and behavior of thin films of metal led to the discovery of the true nature of the operation of polishing. In this operation a true skin is formed over the polished surface. This skin gives unmistakable signs that it has passed through a state in which it must have possessed the perfect mobility of a liquid. In its final state it possesses distinctive qualities which differentiate its substance very clearly from that of the unaltered substance beneath it. It is, for instance, much harder, and, even when formed on the surface of a crystal on which the hardness varies in different directions, its hardness is the same in all directions." The discovery that layers of a solid, many hundreds of molecules in thickness, can have the mobility of the liquid state conferred upon them by purely mechanical movement, opened up a new field of inquiry into the internal structure of metals which have been hardened by cold-working. As a result of this inquiry a theory of the hard and soft states was suggested. According to this theory, hardening results from the formation at all the surfaces of slip or shear of mobile layers similar to those produced on the outer surface by polishing. These layers only retain their mobility for a very brief period and then solidify in a vitreous amorphous state, thus forming a cementing material at all surfaces of slip or shear through the mass. In the use now made of the term amorphous, it means non-crystalline in the most intimate sense of the word; in this state molecules are not marshalled in crystalline order and orientation. The addition of the qualifying term "vitreous" narrows the field to substances which in some degree resemble the glass-like form assumed by the silicates when they are solidified from the molten state.

FIG. 1—TWINNED CRYSTALS IN ANNEALED ALPHA BRASS

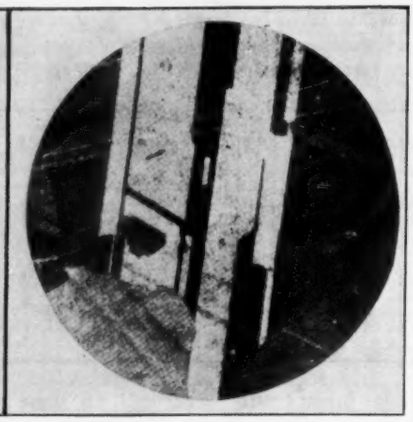


FIG. 2 — THE SAME AREA UNDER OBLIQUE LIGHT AT A DIFERENT ANGLE

Beilby draws attention to the tendency which has been manifest amongst physical chemists in their study of the equilibrium conditions of alloys to regard the crystalline phases as the chief, if not the only, kind of stability which is open for scientific consideration or treatment. The rigid application of phase-rule principles has no doubt been the cause of this somewhat limited view becoming rather fixed. It is quite true that, from phase-rule considerations, the idea of an amorphous cement co-existing with solid crystals at temperatures much below those at which the mass begins to melt, would appear to be impossible. When, however, the whole of the facts are taken into account, it is evident that this is not the case, and, indeed, it is by this very means, as will be shown later, that a feasible explanation of the mechanism of annealing and crystal growth can be advanced. With the removal of the only possible theoretical objection which can for the present be advanced against Beilby's theory of hardening metals by cold-working, we believe that this theory can be accepted as highly satisfactory. It was with this in mind that we were led to inquire if it could be extended so as to include those alloys which are capable of being hardened by quenching. Many explanations have from time to time been put forward for this particular phenomenon, which, probably owing to the subtle na-

Abstract of a paper presented at the May meeting of the British Iron and Steel Institute in London. C. A. Edwards, one of the authors, is professor of metallurgy at Manchester University and H. C. H. Carpenter is professor of metallurgy at the Royal School of Mines, Imperial College of Science and Technology, London.

ture of the changes that occur during the operation and an incomplete knowledge of the same, have been of extremely different characters. Before Beilby's theory can be extended in this direction it is necessary to show that, when alloys such as steel are quenched from temperatures which are above their critical points, the mass is subjected to stresses which cause internal crystalline deformation or slip with the formation of amorphous layers, and that these layers are preserved down to the ordinary temperature. As an introduction to this side of the question, it will be advantageous first of all to refer to recent ideas relating to the existence of amorphous material at the boundaries of ordinary and twinned crystals.

Crystal Twinning

The question of metallic crystal twinning is one which is extremely interesting from a theoretical standpoint, and its cause and general physical interpretation have given rise to a considerable amount of scientific research, and have provided much food for speculative thought. Moreover, it has been recognized for some time that when crystal twinning is found in metals, the properties of a metallic mass are different from one in which untwinned crystals are alone present. In many cases these differences have been proved to be directly associated with the presence or absence of crystal twinning, but we are inclined to think that the full effect of the twinning, which is produced under certain conditions, has to some extent been imperfectly realized, or at least the twinning has not been regarded as the cause of the observed phenomena.

In general terms Ewing has given a clear definition of the nature of crystal twinning. He has said: "Twinning was sometimes the direct result of straining actions, but was more often produced when a metal, after having been strained, was annealed. The nature of twinning was perhaps most easily intelligible if the crystals were considered as built up of layers of 'brickbats', and after one layer had been completed the next layer had all the bricks turned round through an angle of 180 degrees. The result would be a twin formation. In the microscope twinning was shown by the appearance of a dark band in a crystal parallel to a lighter portion, or vice versa. Under strain twinning was indicated by an abrupt change in the direction of the slip bands."

By changing the position of oblique light directed onto a specimen under the microscope, a characteristic optical effect is produced when twin crystals are present. Thus the twins may be made to appear light or dark according to the angle at which the light rays fall upon their surfaces. This is shown in Figs. 1 and 2. The abrupt change in direction of the slip bands passing from twin to twin is illustrated in Fig. 3.

It is, however, necessary to state that the true nature of twinning is less easy to understand than Ewing's remarks would seem to imply, not only because it may be brought about in a variety of ways, but also because the conditions and degree of its manifestation are apparently widely different.

At this stage it is important to allude to the fact that Beilby's theory of an amorphous condition has been opposed upon the ground that it is inconsistent with the physico-chemical law known as the phase rule.

FIG. 3—ABRUPT CHANGE IN DIRECTION OF SLIP BANDS PASSING FROM TWIN TO TWIN

FIG. 4 — TWIN CRYSTALS PRODUCED BY DIRECT MECHANICAL DEFORMATION OF PURE TIN

If, however, the fundamental requirements of this law are carefully considered, along with what is known of the mechanism of annealing, we are of the opinion that no objection even of a theoretical kind can be advanced against Beilby's theory.

The phase rule defines the number of phases which are capable of coexisting in equilibrium in any particular system for an indefinite time. So far as the object of this paper is concerned, it is only necessary to point out that according to the above rule, the liquid of a pure metal can exist in contact, and in equilibrium, with its own solid only at one particular temperature, viz., the freezing temperature, when the pressure is constant. It is, however, most important to remember that the rule makes no stipulation as to the time it is necessary to allow for any unstable phase to be converted into its stable variety. Therefore, if it can be demonstrated that an unstable phase or constituent does in the slightest degree, and at any temperature within its unstable range, tend to be converted into the stable condition, the requirements of the phase rule are amply satisfied. The actual time it would take for the conversion to be completed is, so far as this question is concerned, of no theoretical importance. In actual practice it may, and indeed under certain conditions it does, take an almost indefinite number of years for the whole of a transformation to be completed. In most cases the velocity of this kind of change is at a maximum, when the mass is at a temperature not very much below that of the normal inversion temperature, but in some the tendency for an unstable phase to take up its more permanent form increases as the temperature is raised to just below the critical change point.

Bearing these conditions in mind, we may now turn our attention to the question whether Beilby's theory of the existence of amorphous layers at the surfaces of internal slip, or the extension of that idea by Rosenhain and Ewen, to amorphous envelopes surrounding unstressed crystal grains, is in any way at variance with the requirements of the phase rule. According to the phase rule, if the pressure factor is left out of consideration, two phases of a pure metal cannot coexist in equilibrium over a range of temperature. It therefore follows that the amorphous layers and envelopes or the metallic crystals are in an unstable state, and that one or the other must tend to change. It is known that the crystalline condition is stable below the freezing temperature. The phase rule does not stipulate that the amorphous or supercooled liquid cannot possibly exist below the freezing temperature. All

FIG. 5—THIN TWINNED LAMELLAE IN STRAINED TIN

FIG. 6 — TWINNED CRYSTALS PRODUCED BY QUENCHING COPPER-ALUMINUM ALLOY

FIG. 7 — THE SAME AREA UNDER OBLIQUE LIGHT AT A DIFFERENT ANGLE

that it demands is that there should be a tendency for that phase to change to the crystalline form. There is fortunately ample evidence to prove that this actually happens in all annealing processes.

On the one hand Beilby has shown that the amorphous layers that are produced during the cold-working of metals recrystallize when the mass is heated above a certain temperature which is far below the freezing temperature. On the other hand, it is well known that when metals are annealed or heated even at temperatures some hundreds of degrees below their freezing point, the crystal grains perceptibly increase in size; indeed, in some instances, growth of this kind is by no means negligible when the mass is maintained at ordinary temperatures.

It is obvious that whenever crystal growth occurs, the space occupied by the amorphous cement must inevitably become less. This fact alone may be regarded as a proof that the amorphous material at the crystal junction is really an unstable phase which will pass into the crystalline form. Hence the requirements of the phase rule are satisfied, and it follows as a logical consequence that all metals as they exist in everyday use are, from a physico-chemical standpoint, unstable, for each can only be regarded as being in a perfect state of equilibrium when the mass consists of an aggregate of crystal units which possess the same orientation, and are undivided by amorphous boundaries.

Indeed, we think it is not going too far to say that the crystal growth produced by annealing is directly due to the unstable nature of the amorphous cement. In all probability this cement acts as a medium or carrier, much in the same capacity as do ordinary electrolytes, whereby the substance of one crystal is transferred to another. Thus a crystal grain which is growing does so because it is electro-positive to adjacent ones which are becoming less. It is also necessary to note that when a metal or metallic alloy passes through a critical temperature on heating or cooling, the amount of amorphous material present may suddenly increase, in virtue of the fact that the whole mass is thereby momentarily decrystallized, and the process of recrystallization has to begin again. When metals are distorted in any way with the formation of amorphous layers at the gliding surfaces, the operation of any subsequent annealing simply consists in the elimination of those layers by recrystallization. If the metal is capable of forming twin crystals, a large proportion of the amorphous material may form straight boundary lines which divide twin crystals of different orientation; if not, the amorphous material is, so to speak, washed to the boundaries of polygonic grains.

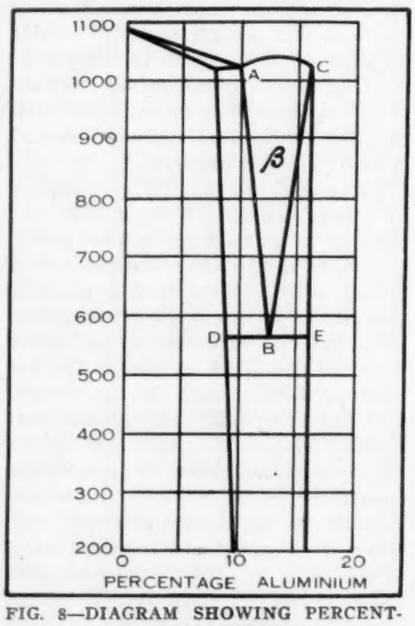


FIG. 8—DIAGRAM SHOWING PERCENTAGE OF ALUMINUM

Rosenhaim has said that: "Twin lamellae are known to have no tendency to revert to their former orientation; indeed, when a twinned material is annealed, the twinning increases rather than decreases." The latter part of this sentence does not seem to be quite in agreement with what we have found after examining a large number of various types of twinning, and the effect upon them of further annealing. We have found invariably that once the mass has been heated to the temperature at which recrystallization occurs, the number of twins decreases and their size increases with continued heating, and in many cases the twinning can be completely eliminated at temperatures much below the melting point. There is, therefore, a tendency for twin crystals to revert to a common orientation, though it may not be manifest at ordinary or low temperatures. In all probability this reversion does not occur bodily but slowly, layer by layer, in the manner described for the ordinary growth of crystals. Having discussed at some length the various theories relating to the straining of metals, the nature of crystal twinning, crystal growth, the formation and elimination of amorphous films and their effects upon the relative hardness of metals, we may now turn to the special form of hardening which is produced by quenching certain alloys from moderately high temperatures.

The allotropic theory of hardening was first enunciated by Osmond in his classical researches on "The Critical Points of Iron and Steel", but since that time the interpretation of the facts upon which this theory rests, and indeed the theory itself, have been modified in some rather impor-

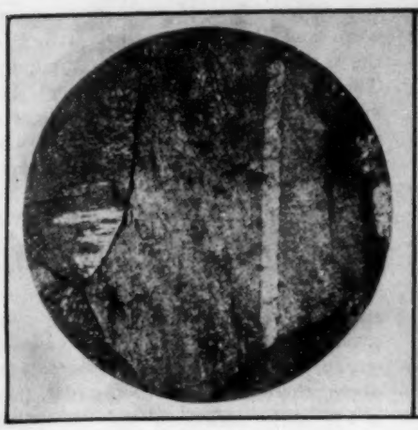


FIG. 9—TWINNING IN QUENCHED CARBON STEEL

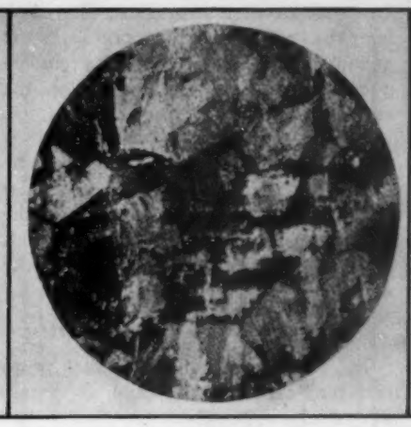


FIG. 10 — MARTENSITE QUENCHED CARBON STEEL UNDER VERTICAL LIGHT

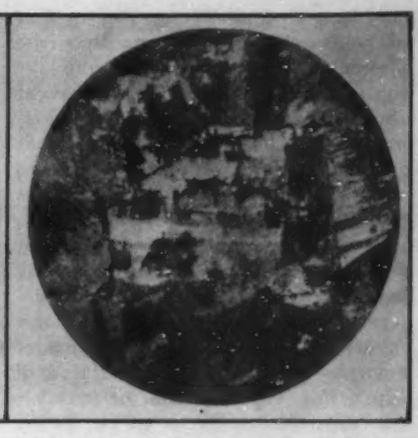


FIG. 11 — MARTENSITE QUENCHED CARBON STEEL UNDER VARYING OBLIQUE LIGHT

tant respects. In the early days of this theory, Osmond was unable to decide whether the critical points Ar3 and Ar2 were totally distinct and independent of each other, or whether Ar2 was merely the lower limit of the Ar3, which was retarded by the presence of a little carbon. Provisionally he asserted that iron below Ar2 possessed the molecular form Alpha and above Ar3 the allotropic form Beta. At temperatures between those two points, when they were distinctly separated, he considered that the metal consisted of a mixture of the two varieties Alpha and Beta. He also gave figures illustrating how the position of the recalescence is lowered when the cooling of a steel containing about 0.9 per cent of carbon is accelerated. As is shown by these figures, when the rate of cooling is very rapid the changes which take place during slow cooling are not produced.

What is Hard Steel?

Osmond's conclusions were that "Hardened steel is a steel in which the iron and carbon have preserved more or less completely in the cold the condition which they possessed at high temperatures. The heat of the change that has not been affected remains disposable in the metal, and may be termed the latent heat of hardening. I conclude that hardened steel owes its properties principally to the presence of Beta iron, which is hard and brittle by itself at the ordinary temperature. Carbon in the state of hardening-carbon maintains iron in the Beta state during slow cooling down to a temperature which is in inverse proportion to the amount of carbon contained in the metal. The influence of carbon is of the same character as that of the rate of cooling, and both combine to produce the final result. The rate of cooling alone is not sufficient under ordinary conditions in which hardening is effected to maintain an appreciable fraction of the iron in the Beta condition. But as under the same conditions it is easy to maintain the carbon in the state of hardening-carbon, and as the hardening-carbon imparts stability to Beta iron, it is evident in what manner Beta iron may be successfully preserved up to the ordinary temperature by the aid of carbon. The more rapid the cooling the more incomplete are the changes and the harder is the hardened steel. It should be remembered that at this period and for some time later the Beta theory, as it is called, referred to the iron when at temperatures above the Ar3 point as being in the Beta condition. That theory as it was then known was entirely independent of the condition of the iron when at temperatures between the Ar3 and Ar2 points. At a later period, however, it was considered by Osmond, Roberts-Austen, and others who took up the views of the so-called allotropists, that the Ar2 point was quite distinct from the Ar3 point, and they came to regard the Ar2 point as corresponding to an allotropic inversion in the iron. From that time onward the Beta theory as it is applied to the hardening of steels really became an entirely different theory, but unfortunately the same nomenclature was retained. Thus the range of temperature between Ar3 and Ar2 became known as that in which the iron existed in the Beta state, and what was previously known as Beta iron—above the Ar3 point—was afterwards spoken of as Gamma iron. These alterations in the theory are of fundamental importance, particularly when the details of the case are considered. At first allotropists definitely asserted that iron when in the Beta condition (which was afterwards known as Gamma iron) was hard and brittle of itself at the ordinary temperature, but subsequently they came to the opinion that Gamma iron was really soft under all conditions of its existence, in other words, whether it is in a stable or an unstable condition. The present standpoint of the Beta hardening theory is that steels owe their hardness when quenched to the iron as it exists between Ar3 and Ar2.

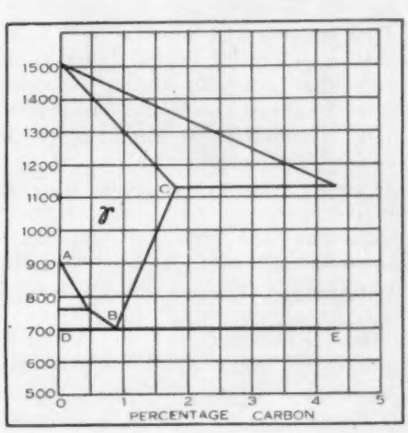


FIG. 12—PERCENTAGE OF CARBON IN IRON SOLUTION

The "Carbonist" Theory

In 1893 Metcalf and Langley gave a concise enunciation of what may be regarded as the "carbonist" theory of hardening. In this theory no special emphasis is laid on the fact that iron can exist in different allotropic forms. Their statement was to the effect that hardening is due to the enforced solution of the carbon in iron by sudden cooling, the hardness being a direct function of the rapidity of cooling. Hardening is accompanied by great internal strains. The molecular stresses set up produce

hardening in a similar manner to that of cold working. Carbon alters the molecular aggregation, and the resulting strained grouping is brought about within certain temperature limits.

The conception that hardness is associated with fineness of structure has been experimentally proved by Beilby, though his standpoint was different from that taken up by Grenet. Beilby has shown that when metals are deformed by cold-working they become harder as a result of the formation of amorphous layers at the surfaces of slip. For some reason or another the experimental facts which Beilby published and the careful deductions he made, did not for some time receive from metallographists the full consideration they so richly deserve. In recent years, however, this work has attracted a great deal of attention, and his theories have been used to explain satisfactorily many phenomena of a widely different nature. Thus in connection with the hardening of steel by quenching, Osmond says: "When two grains possessing different orientation touched one another, their respective reticular systems could not interlock, and there were strong reasons for the belief that there existed between the two grains a sort of amorphous envelope, the average thickness of which was of the same order of thickness as the crystalline molecule. If it was assumed, which it was admissible to do, that in the case of a hardened steel the average diameter of the actual grain—invisible under the microscope, was also of the same size, the idea might be entertained that in the hardened steel the iron might be amorphous. That would correspond to Beilby's hard iron."

To extend logically Beilby's theory of hardening metals by cold-working to hardening them by quenching from moderately high temperatures, it is, however, necessary to show that during the very short period of the quenching process the mass undergoes some internal movement on the surfaces of slip or gliding planes; or, in other words, that the metal is thereby strained, and, if this can be done, it is then necessary to give adequate reasons for supposing that the amorphous layers produced as a result of the straining are retained in the mass when it is cold.

Twin Crystals in Carbon Steels

In discussing some of the properties of carbon steels, and of certain alloys of copper-aluminum which are in many respects very similar to carbon steels, it was suggested by one of us that the characteristic acicular structure of these two kinds of alloys which is formed when they are quenched is really due to the formation of an innumerable quantity of twin crystals. The same author has since been able to prove the accuracy of this suggestion for the case of certain copper-aluminum alloys. See Figs. 6 and 7, which were taken on the same area under oblique illumination after rotating the specimen through an angle of about 180 degrees. It is important to note at this stage that this type of crystal twinning is somewhat different from that which is so frequently seen in annealed metallic specimens. In the latter it is seldom that more than one or two twins are seen in each grain; whereas in the former the twins are extremely numerous, and frequently appear to intersect each other. The dimensions of the twin crystals that are formed on quenching are affected in a remarkable manner both by the composition of the alloy and by the rate at which it is quenched.

Now it is interesting, and cannot but prove to be instructive, to note that the copper-alluminum alloys containing from 9 to 16 per cent of aluminum and the carbon steels fall into the same physico-chemical category. Their respective constitutions for varying temperatures are represented in Figs. 8 and 12. From these diagrams it will be seen that at temperatures above the lines ABC, it is found that they each consist of a series of homogeneous solid solutions, which on cooling undergo changes of precisely the same nature. It is, therefore, not very surprising that, when members of each group are quenched from temperatures above their highest critical point, they show similar structural markings when examined under the microscope. Without in any way wishing to press this analogy too far, we feel we are quite justified in drawing attention to it, particularly as it is generally recognized that our knowledge of the true constitution of quenched steels is far from being satisfactory. With this in mind we have carefully examined a large number of quenched steels which contained the metallographical constituent known as martensite, with the view of testing whether the martensitic markings are associated with crystal twinning, in a similar manner to those observed in the quenched copper-aluminum alloys.

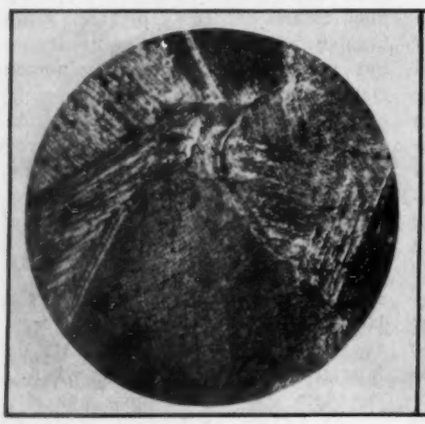


FIG. 13 — STRUCTURE OF TEST BAR UNDER VERTICAL LIGHT

FIG. 14 — THE SAME SAMPLE UNDER OBLIQUE LIGHT

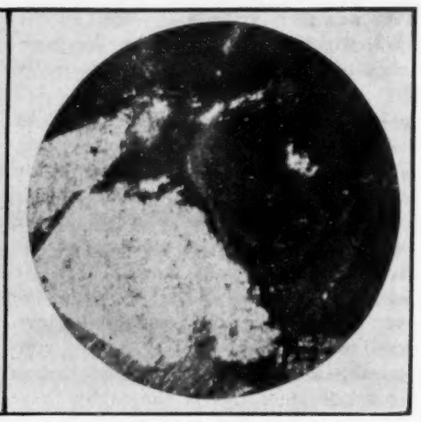


FIG. 15 — THE SAME SAMPLE UNDER ANOTHER OBLIQUE LIGHT

Fig. 9 was taken from a quenched specimen of pure carbon steel. The long narrow light crystal inside the central grain proves beyond doubt that twinning takes place when steels containing no manganese are quenched from temperatures above their highest critical point. A somewhat different form of twinning in a much more pronounced degree may be seen in Figs. 10 and 11, which were taken from the same area under varying oblique light. When viewed under direct light, the change in the direction of the acicular martensitic mark-

(*Continued on page* 1244b.)

Specifications for Chipper's Goggles

The Illinois Steel Co., Chicago, has prepared a set of specifications for chippers' goggles and has designed a machine for testing the strength of the lenses.

The strength of the lens is tested by dropping a small steel ball on it from a predetermined height. The drop test machine is illustrated in Fig. 1, while Fig. 2 shows a top and side view of the white pine goggle support. The latter is designed to hold the goggles under test in such a manner that the frame is given a proper bearing on rubber and cotton composition strips, without permitting the lens itself to rest on the support or to receive any backing other than that given by its own frame.

The height of the drop is 21 inches

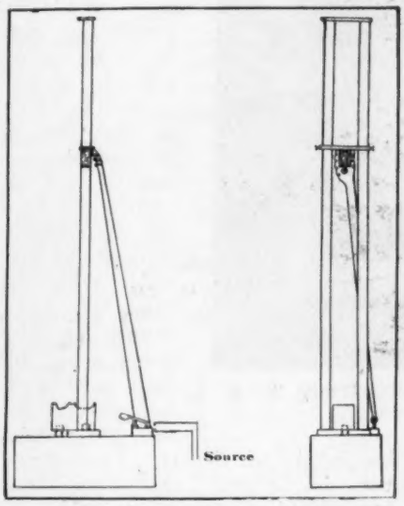


FIG. 1—DROP TESTING MACHINE FOR GOGGLES

from the bottom of the ball to the surface of the goggle lens. The ball is made of steel and hardened. It is 5/8 inch in diameter and weighs approximately 16 grams. The ball is released so that it falls freely without any initial momentum. Fifteen consecutive blows are given on the center of the lens, on the surface which is exposed to flying matter. On each shipment of a gross or less of goggles one dozen must be tested, and of this dozen, 25 per cent, or three pairs, must stand 15 blows without breaking or cracking. This means that the six lenses of the three pairs of goggles in the test dozen must be intact after the 15 blows. If less than 25 per cent stand the test, the entire gross is rejected.

If in the test dozen of goggles, any goggles break under the drop in such a way that glass flys from the inside surface of the lens, meaning the surface that is next to the eyes of the man wearing the goggles, then the entire gross will be rejected, even if three pairs of goggles have successfully withstood 15 blows each under the drop test.

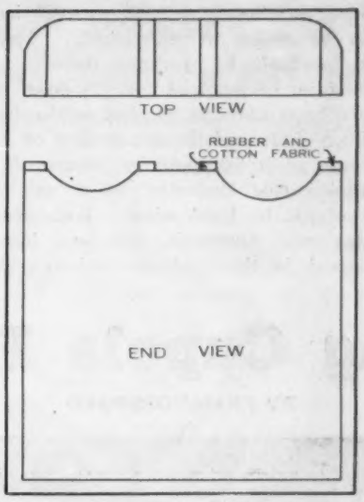


FIG. 2—WHITE PINE GOGGLE SUPPORT

The specifications require that the thickness of each lens shall be measured at four quarter points on a circle whose radius is equal to two-thirds the total radius of the lens. An extreme variation of 0.0005 meter is allowed in the thickness of the lens between any two points. An extreme variation in thickness between two lenses in the same pair of goggles of 0.001 meter is permitted.

According to the Illinois Steel Co.'s specifications, the cost of the dozen goggles used for the test is divided equally between the manufacturer and the purchaser if they successfully stand the test. If rejected, the goggle manufacturer bears the cost.

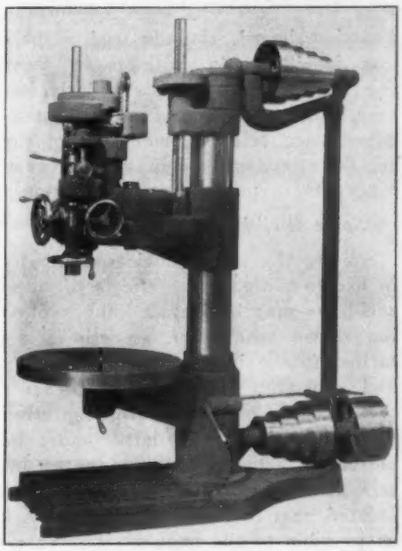


FIG. 1—ROTATING HEAD RADIAL DRILL

Rotating Head Radial Drill

The Willmarth Tool Works, Cleveland, is placing a new radial drill on the market, the most prominent feature of which is in the manner of moving the head and arm for locating holes. The head rotates about a large circular bearing on the arm, and the arm rotates about the column as in the usual type. This produces a double swiveling motion, so that any hole within the capacity of the machine may be readily located. A self-locking spiral gear and rack are provided for moving the head.

The bearing of the head on the arm is 17 inches in diameter, and is provided with an annular ring inside for holding it central, and a heavy pivot bolt for holding the two parts together. A powerful eccentric clamp locks the head to the

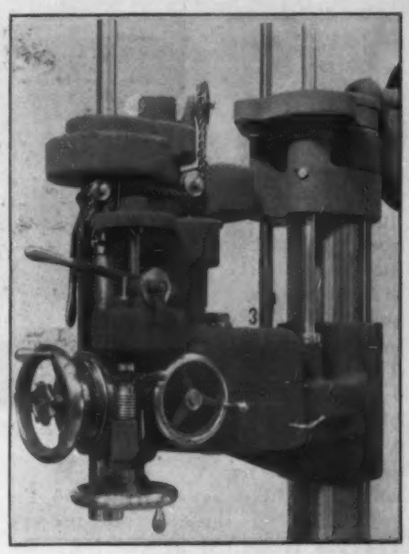


FIG. 2—DETAILS OF HEAD MECHANISM

arm. The column is of the post and sleeve type. The post has a heavy lower portion, and extends up to the top member, which is bolted to it, making a braced construction. The column sleeve telescopes the post, and has bearings at both top and bottom, also a ball thrust bearing at the bottom end. The sleeve has a powerful binding clamp at its lower end, which when tightened, is said to produce the effect of a solid column.

There are eight changes of speed, from 35 to 375 revolutions per minute, arranged in geometrical progression. Four changes are obtained by the cone pulleys and four more by the back gearing, which is provided in the spindle driving gears.

The tapping mechanism is actuated by a jack shaft in the head, running at high speed, and drives through ring clutches, which are operated by means

of a lever in front of the machine, enabling the workman to easily start, stop or reverse the spindle.

The spindle has a No. 5 Morse taper hole, is 3¼ inches in diameter at its large end and 1¾ inches at its smallest section.

The feed is provided by selective gearing, which drives a worm and worm gear, that in turn drives the feeding pinion. Six changes of feed are provided, ranging from 0.006 to 0.027 inch per revolution of the spindle. These are available by operating the dial on the front of the feed box. A quick return hand wheel is attached to the feed pinion shaft, and the engagement of the worm to it is made by means of a friction ring controlled by a unit in front of the hand wheel. Both depth gage and automatic trip are incorporated in the feed mechanism. The principal dimensions of the machine are as follows:

Drills to the center of a 48¾-inch circle.
Greatest distance from spindle to base is 52½ inches.
Greatest distance from spindle to table is 27 inches.
Vertical traverse of spindle is 11¼ inches.
Vertical traverse of arm on column is 28 inches.
Cones are 8, 9⅝, 11⅜ and 13⅛-inch in diameter by 3½ inch face.
Tight and loose pulleys are 14 inches in diameter by 4 inches face.
Height of machine is 96 inches.
Weight of machine is 3,500 pounds.

Preventing Cupola Explosions

BY FRANZ OSSWALD

THE operation of cupolas as well as blast furnaces is attended with danger of explosions, which under certain conditions may result in disaster. Such explosions, practically without exception, are due to the presence of carbon monoxide in the wind box and sometimes even in the blast pipe. These conditions are made possible by short interruptions in operation during which the blast is shut off and the gas backs up through the tuyeres. The gas is ignited by the hot coke in the cupola as soon as the wind is turned on again and a more or less violent explosion follows.

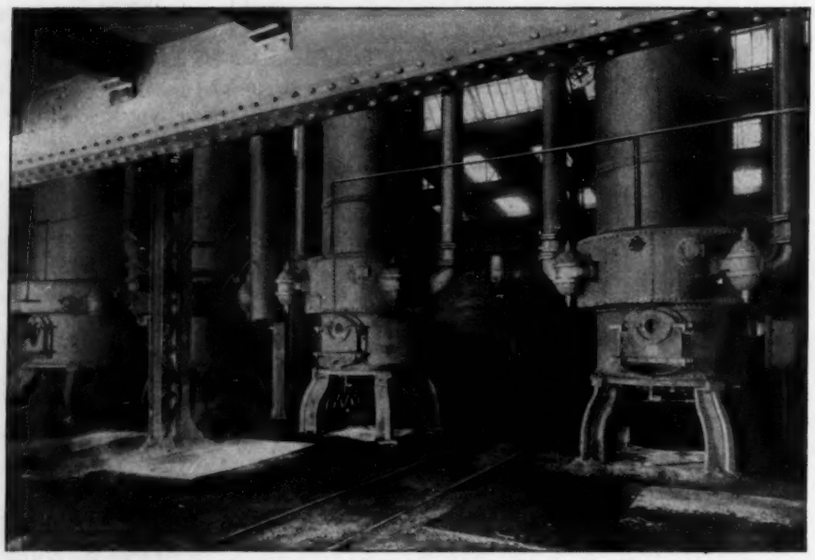


FIG. 1—FOUR CUPOLAS IN A LARGE GERMAN FOUNDRY EQUIPPED WITH DEVICES TO PREVENT EXPLOSIONS

A very instructive paper on the causes and effects of a cupola explosion in which four men were hurt more or less seriously was presented at a recent meeting of the German Association of Foundrymen. Another cupola explosion in which two persons were hurt was reported by the Prussian board of industrial inspection in 1910. In both these cases the explosions were particularly severe, whereas those of minor consequence are seldom made public; the cupola attendants often do not even report them to the men in charge.

Some Well-known Safety Devices

Among the safety devices generally in use to mitigate the effects of these accidents may be included the explosion doors which are sometimes attached to the blast pipe or wind box and the stop valve which prevents the carbonic oxide gas from entering the blast pipe. The latter must be closed by hand in case of short interruption in operation, and should be located next to the wind box, as close as possible to the cupola. The valve, of course, cuts off only the blast pipe and does not prevent the dangerous gas from entering the wind box. Certain German industrial authorities specify that doors shall be placed in front of the tuyeres which can be opened as soon as the blast is shut off; the outside air thus admitted will burn the gas escaping through the tuyeres. When the blast is again turned on, the doors must remain open to allow passage for any gas remaining in the air jacket. They should not be closed until the blast has entered the cupola. In actual op-

(*Continued on page* 1244b.)

Translated from Stahl und Eisen specially for THE IRON TRADE REVIEW, by Gustav Fisk. The author is Industrial Inspector for the Imperial government, Vienna.

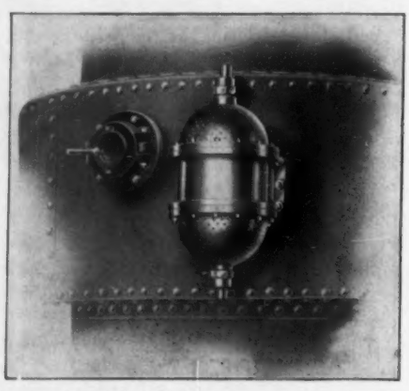


FIG. 2—SAFETY APPARATUS FIXED TO WIND BOX

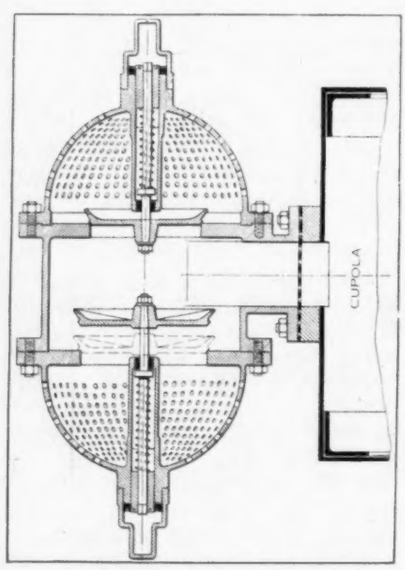


FIG. 3—VERTICAL SECTION OF CUPOLA SAFETY DEVICE

The Business Man and Congress

Legislation of the Past Two Sessions Will Be Put to Test of Actual Operation —New Session Opened With Limited Program

BY L W MOFFETT

ACTUAL effects of the greater portion of the legislative program enacted by the first Democratic administration that has ruled the government in the executive and both congressional branches in about 20 years will begin to be more materially felt early in the new year. This legislation perhaps represents more than ever before in the history of the country the ideas and ideals of one man. For, regardless of political tenets and prejudices, it is widely conceded that Woodrow Wilson has influenced congress more than any of his predecessors. His wishes, almost for the asking, have become the laws of the land. While there were eruptions in his own party, the general rule was for it to support him loyally, and, aided by Republican support, he pushed through the legislation he desired at the two sessions of the Sixty-third Congress.

Laying aside the question as to the propriety or impropriety, safety or danger, of the position he assumed, and the spirit in which he took the role, it has furnished and will furnish the student of government an intensely vitalized subject for analysis. It may be left with him to determine whether the so-called domination of the President has been overstated or minimized; whether he was a benevolent leader and thinker, or an arbitrary executive or merely a partner of congress. For the industrial world of today it does not matter much what the answer is.

The opportunity of leisurely deliberation does not remain with the business man. He must meet the actualities arising from the legislation, and not stop to place his ear to the ground to hear favorable or unfavorable criticism of laws enacted and the manner of their enactment. One way or the other, for good or bad, the legislative machinery is thrown into gear, and the product must be accepted. That business will endeavor to make the best of the new situation, goes without saying.

Claims, even though of recent resurrection, that agitation is often purposely set in motion to place in disrepute new laws—the tariff law, for instance—have been thoroughly disproven. Threats to investigate industries to determine whether working forces were cut or wages reduced for the purpose of creating an artificial depression and placing odium on the new tariff law naturally fell flat.

Effect of the War

The breaking out of the European war suddenly shut off the opportunity to continue the test of the new tariff law, the only big legislative measure of the present administration which has been given a substantial tryout. The depression which it has been charged by many manufacturers was caused by the tariff, whether psychological or not, made many enemies of the Underwood-Simmons law.

Whether the iron and steel industry would have enjoyed a healthy revival of business in September as many of its leading representatives confidently expected, had it not been for the war, is a matter of conjecture. At least neither that nor any other industry was investigated for cutting wages and reducing working capacity. The joke, while grim, would have been turned upon the investigators.

Conclusive evidence has been displayed by the business world that it will not foolishly bite off its nose to spite its face. So what has been done in a legislative way is to be put to the acid test of practical operation, with no favors asked or given. It is happily the attitude of business nowadays to disregard politics incubated just for mere partisan preferment. Conversely, business is being urged by some of its ablest proponents to take a more active part in politics for its own welfare, along purely business lines and not for the purpose of political vantage for any creed. Business is progressively growing more coldly critical of real results of legislation. It has come to the stage where the question is not, "What party is supporting this measure?", but rather, "Is this a good, sound measure?"

Business, big and little, recognizes that morals and just legislation mix splendidly, and make a concoction good for the employer and the employe, and is being persuaded to take a more lively part in the mixing. Contention is made that the remedy for ills of the country is not less politics, but more interest in politics. The essence of popular government, it is pointed out, is based on politics and the citizen is being reminded earnestly that neglect of public duties is an act of enmity to the public. The business man is being told to study closely what has been accomplished in a legislative way and what is being contemplated, and to lend his efforts toward seeing that the good is separated from the bad; then to retain the former and discard the latter wherever possible.

It is not the stereotyped mouthing of "Pro bono publico," "Veritas" or other familiar "authors" to say that favorable public opinion can be obtained by business, once it seeks it earnestly. It has already made healthy strides in that direction, but further progress is desirable. Then things can be achieved more readily. Nothing more strongly proves the faith in this than the fact that the New York State Bankers' Association recently appointed a publicity committee for the teaching of political events. It was inspired by an address of Frank A. Vanderlip at the last convention of the association. He advocated strongly the entrance of bankers and business men into politics, not machine politics, but into the field of political discussion and activity, so that the public could derive information about business from sources other than those represented by professional politicians.

Certainly the business world has confronting it a great mass of legislation, enacted at the two sessions of the Sixty-third Congress. It is now given an opportunity, while it benefits or suffers, to scrutinize the new laws. A few figures in this connection might not be amiss to show the surfeit of legislation introduced at these two sessions. While in quantity the legislation enacted was perhaps unparalleled, it was nothing compared with what was proposed.

The Sixty-third Congress met in extra session on April 7, 1913, and its second session ended Oct. 24, 1914, a record of 567 days, exceeded in length only by the Fortieth Congress. The latter convened on March 4, 1867, and ended Nov. 10, 1868, lasting 619 days in the aggregate. It was interrupted, however, by several recesses, instead of only one, as was the case between

the first and second sessions of the Sixty-third Congress.

In the senate at the first and second sessions of the Sixty-third Congress 6,642 bills and 701 resolutions were introduced, and in the house 19,307 bills and 1,070 resolutions. These remarkable figures made a good companion piece for the long-distance and extended talking indulged it at those two sessions. The Congressional Record for the first session of the Fiftieth Congress, when the Mills tariff bill was under discussion, consists of 10,236 pages. The Record for the first session of the Sixty-third Congress contained 6,528 pages. With "leaves to print" the Record for the entire two sessions of the Sixty-third Congress contained 18,745 pages, greatly exceeding any previous total. There were, out of this huge volume of bills, resolutions and talk, 215 measures which attained the dignity of law. The vast portion of the others were pigeonholed, and, like the garrulity accompanying them, forgotten. Still there remained three more months of the Sixty-third Congress.

It might be well for the business world to study this phase of the situation, to see whether less talk and more profound work would not be a wiser policy, a good thing financially by saving time, and giving quicker assurance of the merits of the legislation enacted, and incidentally saving the patience of the country. Much of the talk is obviously designed entirely for home consumption.

This is not said in a spirit of captious criticism, and is not by any means directed at Congress as a whole. In its body are really great men, ably and faithfully serving the nation. To sneer indiscriminately at members of congress is taken by the thoughtful business man of large experience to be narrow, for he is wideawake and like the Psalmist's righteous man, "sitteth not in the seat of the scornful." Business men in general, whether they have come in contact with political affairs, or not, would find through close acquaintance, that an overwhelmingly large majority of the members of congress are very likeable and agreeable personally. To get into close touch with them, exchange and understand points of view, would hasten more good legislation, with less talk, than any other method. For with public opinion back of him, the business man would not need to despair of succeeding in his mission when in Washington on legislative matters. He need not fear the cry of "lobbyist." Going direct to the chairmen of committees and asking for public hearings on matters in which he is interested to point out the situation precisely as he, through experience, sees it, can't fail to bring favorable results. President Wilson himself has indicated repeatedly that he desires to encourage such an attitude on behalf of all the interests of the country. He took particular pains to point out this idea when the claim was made that an erroneous interpretation was put upon his charge that an "extraordinary lobby" was in Washington trying to influence tariff legislation.

Meeting Business Men

The president, too, in scores of expressions, has spoken words of assurance for the business world and for the length of time he has been in the White House has perhaps met more important business delegations than any other executive. Included among the prominent men in these bodies who are known to the iron and steel trade were President James A. Farrell, of the United States Steel Corporation; President E. A. S. Clarke, of the Lackawanna Steel Co.; President E. P. Thomas, of the United States Steel Products Co.; President Alba B. Johnson, of the Baldwin Locomotive Works and President Henry Ford, of the Ford Motor Co. Other men President Wilson has met include eminent financial and railroad heads.

The President has insisted to newspaper men that he wants to be "humanized" and evidently he feels that meeting men of the industrial and financial world is one desirable process toward that end, beneficial to the country and himself. It has been urged that the business man should bring about further extension of this interchange of ideas so as to better understand Congress than is the case at present.

The more important measures enacted by Congress which President Wilson urged included the tariff, the banking and currency act, and the Clayton and Federal Trade Commission anti-trust bills. The tariff law became effective Oct. 3, 1913, the currency law, on Nov. 16, 1914, and the two anti-trust laws, like the currency measure, will soon begin to make their effects felt more distinctly. Other prominent administration measures enacted into law included the Alaska railroad bill, authorizing the government to build railroads in Alaska at a limit cost of $35,000,000; a bill authorizing the leasing of public coal lands in Alaska; a bill for the repeal of the Panama canal tolls; the employers' arbitration act; several measures supplemental to the federal reserve act with a view of removing the restrictions on the issue of currency; a bill admitting foreign ships to American registry; a bill establishing a war risk insurance bureau in the treasury department, brought about by a delegation of business men, represented in part by the National Foreign Trade Council, whose committee was headed by Mr. Farrell; the Lever agricultural extension act, a bill regulating sales of cotton for future delivery and the various emergency measures incident to the European war, and a resolution relating to Mexican affairs, resulting in United States troops being landed in Vera Cruz by order of the President, an act approved by Congress.

The President received strong support from Republicans in his anti-trust program, for his currency law, the tolls repeal bill, and other leading measures. Likewise, he was vigorously opposed from within the Democratic ranks by a few on every one of the foregoing bills. The tariff was really more partisan than any other of his measures, and it was the only one in which the President would yield no point worth the name. On the other measures, he yielded readily to suggestions from different sources. Yet, even on the tariff, three Republicans and one Independent of the house voted for its passage and in the Senate one Republican and one Progressive supported it. Peculiarly enough, out of the three national platforms of 1912, the Democratic platform was the only one which did not demand the creation of a federal trade commission.

The Rayburn bill, to control the issue of railroad securities, was apparently abandoned by the administration, but Senator Newlands has announced that he intends to urge the passage of the bill, perhaps at the next session. It was the third measure of the original anti-trust program.

The new session opened on Dec. 7, with a program calling for the enactment into law of the ship purchase bill, intended to build up the American merchant marine; conservation legislation, the water power bill, the Philippine bill, and other important measures.

The business man can readily discern what a vast amount of good or injury may result from the foregoing legislation enacted and contemplated. It offers a fair index for the reason why he is being asked to take a more active part in politics.

The Reeves-Cubberley Engine Co., Trenton, N. J., has received a big order to supply steam engines for the public schools of New York.

How Uncle Sam Helps Commerce

Definite Plan for Promotion of Trade With Foreign Nations—Special Investigations Being Conducted in Central and South America

BY A H BALDWIN

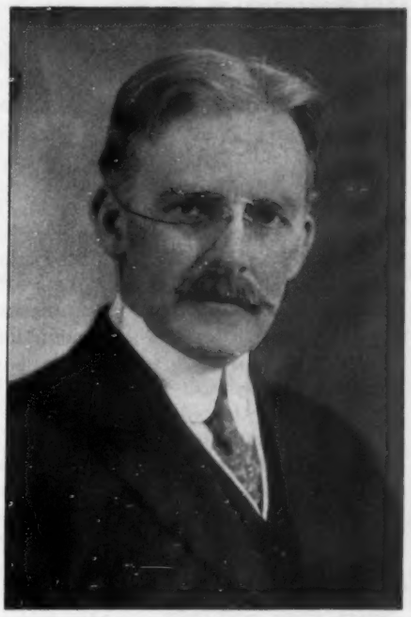
THE federal government in its various branches is the greatest and most powerful organization, considered merely as an organization, that we have. No other system of related human units is to be compared with it in intricacy, in number of its parts or in the variety of the activities of these units. They number hundreds of thousands of men and are stationed all over the entire world. A town in the United States must be small indeed if it does not harbor at least one federal officer, a postmaster perhaps or an agent of the treasury department. In foreign lands at every important trade center, port, or capital it is certain that the state department has stationed a consul, or a diplomatic officer, and then may also be found, here and there, agents of the treasury, a traveling representative of the department of commerce, or of the department of agriculture.

The ramifications of this federal organization are world-embracing, and its purposes are many, all, however, lying within the field of active, useful service in the interest of the nation. And, as the trade of our country has grown year by year, there has grown with it the active utilization of this vast federal organization to aid commerce in every way legitimate to such a system. Today there exists a definite plan for such service for the promotion of trade, a plan involving the employment, in whole or in part, of thousands of men scattered in every state in the Union, and in every foreign land.

The control of this plan of trade promotion lies, naturally, with the department of commerce in Washington, but all the other great departments contribute a share of service, each in its own field. Space does not permit me to even indicate all the details of this cooperative work for commerce, but it is practicable to show briefly how the organization serves the people day by day in building up our export trade.

Primarily export trade is assisted through the collection and distribution of facts by the government agents who respond to instructions from the department of commerce. Such reports on trade conditions and trade opportunities constitute the greater part of the direct aid given by the system.

Reference only can be made here to such indirect aid to commerce as is given by the bureau of light house, which guards our commerce on the coasts and navigable rivers, or by the coast survey, in a similar service. The bureau of navigation and the steamboat inspection service are also a part of the contribution to safeguarding our commercial shipping. Other bureaus and departments have an important share in the work, but the center and heart of it all rest in the bureau of foreign and domestic commerce in the department of commerce. Thence lead all the threads of the federal trade promotion work to agencies at home and abroad. Agencies for collecting, digesting, and distributing useful facts about export trade, and a record of the present activities of that office will show broadly the character and amount of service now carried on to aid our foreign commerce.



A. H. BALDWIN

Mr. Baldwin, previous to his recent appointment as commercial attache at London, was chief of the bureau of foreign and domestic commerce, department of commerce, having been given that position when the bureau was organized, Aug. 23, 1912.

First in importance is the commercial work of our consuls. These busy officers find time in the midst of many other duties to report on trade conditions in their districts, and they are sending in, day by day, records of the facts they deem of interest to our business men. Such reports number tens of thousands yearly, and come from every foreign country. They help enormously to keep our exporters advised of trade matters abroad. In addition to these consular trade observers, who number three or four hundred, there are a score or more of commercial agents, direct representatives of the department of commerce, who travel on special investigations, usually on behalf of a single branch of manufacture or export. Such agents are at this moment engaged in studies of foreign markets in the orient, in Central and South America and in other parts of the world and more are now just leaving Washington as this is written.

Congress has fully realized the importance of accurate reports on special markets abroad and has provided liberally for this work for the current fiscal year (July, 1914 to June, 1915). In addition to appropriations of about $250,000 to care for the service of the bureau of foreign and domestic commerce in the city of Washington, including charges for publications, there has been granted $225,000 for field work at home and in foreign countries. Of this sum $50,000 is made available for promoting commerce with Central and South America alone, in which there is such a marked interest at this time. Under the latter fund, special agents are already at work in a number of investigations. These investigations include intensive studies in Latin America of the markets for such varied products as lumber, furniture, hardware, electrical equipment, machinery and marine supplies, fruit, and clothing of all kinds. Men have been appointed who are conversant with these subjects. Nearly all of them speak Spanish and have had actual experience in Latin countries. They will report week by week on trade conditions, each in the special field assigned to him, and their work cannot fail to be of very practical assistance to our manufacturers and exporters who look to a great expansion of our commerce with the

countries to the south of our nation. Ten thousand dollars of this same appropriation will be used in the office in Washington to edit and publish the material collected by the agents of the bureau in Latin America.

Another fund of $75,000 is available this year for similar work in both foreign markets and the domestic field, and a part will be used to maintain the branch offices of the bureau which are now established in New York, Boston, Chicago, San Francisco, Seattle, New Orleans and Atlanta. These branches aid the department very effectively in bringing the trade information collected by consuls, commercial agents and others direct to the attention of business firms, without unnecessary delay.

Further special studies will also be made under this appropriation. An expert in cotton textile markets and a specially equipped representative of the lumber trade have already been dispatched to the orient, to aid those branches of our commerce as much as possible.

Another cotton textile agent is at work in the southern states giving manufacturers the benefit of his knowledge of markets for their products over-seas.

Supplementing and completing the work of consuls, commercial and special agents, will now be added a group of commercial attaches of the department of commerce in nine or ten of the principal capitals and commercial centers throughout the world.

Urged by Secretary Redfield, congress has rounded out the organization of the trade promotion system of the United States by authorizing the appointment of these special trade representatives of our country abroad, who will devote all their time to studies for the aid of export development. A fund of $100,000 is available for this new corps, and already commercial attaches have been appointed by the secretary of commerce for posts at London, Paris, Berlin, and Petrograd, in Europe, Peking, in China, and Rio de Janeiro, Buenos Aires, Santiago, and Lima, in South America.

These men also will soon be sending in reports the results of their observations in the countries to which they have been assigned. If they carry on their work efficiently, no doubt a volume of trade will be diverted to our shores which has heretofore gone elsewhere, and much intimate knowledge of commercial matters will be placed at the disposal of our business interests.

In order to give wings to all this multitude of reports from the field, the bureau in Washington makes use of all the many facilities for publicity which are at its command. Through its close relations with commercial organizations throughout the United States, it is able to multiply the effectiveness of its bulletins by securing the cooperation of foreign trade committees and other similar agencies. The trade papers also aid very materially to carry the messages received to their special clients in the various branches of commerce. The publications of the bureau itself include a daily paper, "*The Consular and Trade Reports*," a monthly statistical magazine, several quarterly and annual volumes, and a long list of bulletins and monographs by consuls and commercial agents. The titles of some of these bulletins will indicate the range of subjects covered by the work of the government in this field. They include such varied matters as "Foreign Credits," "Packing for Export," "Trade Directory of South America," "Cotton Goods in Russia," "Cuba as a Buyer and Seller," "South America as an Export Field," "Banking and Credit in Brazil, Argentine and Chile," "Customs Tariffs of Japan," "Foreign Markets for Railway Supplies and Equipment," "Machine Tools in Latin America," and so on through almost the entire list of factors in export trade. The bureau issues a pamphlet called "Promotion of Commerce," (to be had on application) with a full record of its activities and a list of its available publications. As is appropriate for a business bureau, most of its issues are now sold by the superintendent of documents, at a nominal charge, which covers only the cost of paper and printing. Firms not familiar with the resources of the government will find it well worth while to communicate with the departments in Washington and find how rich a store of information may be tapped merely for the asking. The reproach that the work of the government in trade promotion is not "practical" holds less and less every day as the relations of the business public and the department grow closer.

The American Smelting & Refining Co., 165 Broadway, New York, has leased the entire thirty-fourth and one-half of the thirty-fifth story in the new Equitable building, and is said to involve an aggregate rental of $125,000 a year.

The Linde Air Products Co., New York City, has established a warehouse at 104 North Fifth street, Portland, Ore., for the convenience of users of oxygen in the northwest.

Notes From Cuyuna Range

Brainerd, Minn., Dec. 28.—At the Brainerd Cuyuna Mining Co. shaft in the city limits of Brainerd a depth of over 85 feet has been reached and ledge is but a short distance away. They are pumping 700 gallons.

At the Wilcox mine, pumping is progressing favorably and but 15 feet covers the drowned pumps. Water was encountered while drifting in the ore.

Sinking operations at the No. 2 shaft of the Cuyuna-Sultana Iron Co. were discontinued until after the holidays. Drills also, in many instances, have been shut down for Christmas and New Year's holidays.

All appearances indicate that the Armour No. 1 mine, silent all this season, is to be worked in 1915. Water in the mine is being led into the 200-foot level of the Armour No. 2 adjoining and is being pumped out by the Armour No. 2. Reports still persist on the range that the Inland Steel Co., which owns the Thompson pit mine adjoining the two Armour mines, is to absorb them.

At Barrows, the Barrows Mining Co., the Barrows-Mississippi Iron Co. and the Brainerd Mining Co. are actively engaged in exploration work. Officers of the Barrows company are very much pleased with the showing made.

At the Crow Wing county poor farm, the E. J. Longyear Co., of Minneapolis, is drilling its eighth hole. One more hole remains to be drilled and the company then has an opportunity to exercise its option to call on the county for a 50-year mineral lease.

Carnegie Dinner

Colonel Henry P. Bope, vice president and general sales manager of the Carnegie Steel Co., will be toastmaster at the annual dinner of the operating officials of that company, to be held Jan. 2 at the Hotel Schenley. Colonel Bope will talk on "Commercial Tendencies of Officials"; John S. Unger, head of the metallurgical department, will describe the work of his department; W. G. Clyde, assistant general manager of sales, will discuss "Personality in Salesmanship"; Judge James H. Reed, "Of the Making of Laws There is No End", and A. C. Dinkey, president, will talk on "Service".

The tube and plate departments of the Wheeling Steel & Iron Co., Wheeling, W. Va., resumed operations Dec. 28, after a shutdown.

Few Furnaces Completed in 1914

Only Nine New Open-Hearths Were Placed in Operation the Past Year and No New Blast Furnaces—An Analysis of the Country's Capacity

BY R V SAWHILL

NINE open-hearth furnaces were completed and placed in operation in 1914. No blast furnaces were built during the past 12 months. In the face of the lightest new construction program carried out in any year for a decade, it is of interest to determine the country's capacity for steelmaking and pig iron production. Is it adequate to meet demand in a good year or have the leaders in the iron and steel industry been guilty of shortsightedness in failing to fortify themselves for better times? Until very recently, it was customary to think of the capacity of the iron and steel industry in terms of blast furnaces. Pig iron production was the gage that determined whether supply was meeting demand. Three years ago, however, the country's production of steel exceeded its pig iron output for the first time. Additions of steelmaking units have been abnormally large in recent years, while there has been a more or less progressive decline in the number of blast furnaces built. To secure the proper purview of the country's capacity, it is now necessary, therefore, to take into the reckoning both the blast furnace plant and the steel mill.

For comparative purposes, 1913 is a suitable year. New high records were established that year in the production of both pig iron and steel castings and ingots. Steel production was 31,300,000 tons, against 31,250,000 tons in 1912. There were 31,000,000 tons of pig iron produced in 1913 and 29,725,000 tons in 1912. The tonnage of steel produced thus exceeded that of pig iron by only 300,000 tons last year but by 1,525,000 tons in 1912. In 1911, the production of steel was only 27,000 tons in excess of pig iron while in the four preceding years the blast furnaces outstripped the steel mills all the way from 1,200,000 tons to 2,400,000 tons.

For two years, therefore, when demand was below normal, steel production was well over 31,000,000 tons while pig iron production was under that figure. Neither year can be reckoned as a measure of the country's full capacity, as demand was not maintained at a level that brought into play all of the commercially available capacity.

Open-Hearth Steel Furnaces Completed During 1914.

Company.	No. of furnaces.	Rated capacity, tons.	Estimated annual production, tons.
Colorado Fuel & Iron Co.	3	50	95,000
Kokomo Steel & Wire Co.	2	75	100,000
National Malleable Castings Co.	1	25	22,000
*Pennsylvania Steel Co.	2	200	480,000
Pennsylvania Steel Co.	1	75	50,000
Totals	9		747,000

Open-Hearth Steel Furnaces Building at End of 1914.

Company.	No. of furnaces.	Rated capacity, tons.	Estimated annual production, tons.
American Iron & Steel Mfg. Co.	4	50	125,000
Bethlehem Steel Co.	6	50	185,000
Central Steel Co.	3	50	95,000
Corrigan, McKinney & Co.	8	75	400,000
Lackawanna Steel Co.	4	60	150,000
Leetonia Steel Co.	2	70	85,000
Lukens Iron & Steel Co.	1	50	30,000
Minnesota Steel Co.	10	75	500,000
Pittsburgh Crucible Steel Co.	2	60	75,000
Youngstown Iron & Steel Co.	3	60	115,000
Totals	43		1,760,000

*Furnaces operate in connection with duplex process.

A careful computation, based on statistics, gathered by THE IRON TRADE REVIEW for a number of years, was published Jan. 1, 1914, in which the country's pig iron capacity was set at 35,000,000 tons and its steel making capacity at 37,000,000 tons. These totals do not of course represent the ultimate capacity in a year of *super*-normal demand. That is, with prices boosted to the high figures of several decades ago, so that every steelmaking unit and blast furnace in the country could and would operate at a profit, these totals would be much too low.

But the factors which militate against this excess tonnage are so important and convincing that they nullify any prospect of its being revived. It is highly improbable that prices will attain any such altitude again. The shifting of markets, with consequent imposition of high freight rates, the exhaustion of raw materials in the immediate vicinity, small-sized and out-of-date plants with consequent high labor and fuel costs are a few of the more important elements which combine to preclude the future operation of much of this excess tonnage. The country's capacity, therefore, must be considered in the light of plants which can operate successfully under such favorable conditions as are likely to prevail. Considering first the pig iron capacity, there is no reason to increase the estimate made a year ago. While no new blast furnaces were built and placed in operation, there was considerable reconstruction work done in remodeling old stacks and in one case a furnace was completely rebuilt. The increase, however, was not convincing enough to change the estimate of the country's commercially available pig iron capacity as being 35,000,000 tons. To arrive at the capacity for steel-making, the increases made during 1914 necessitate a revision of the estimate of 37,000,000 tons made a year ago. During 1912 and 1913, production of steel castings and ingots, as stated above, averaged 31,250,000 tons. With pig iron production at 31,000,000 tons there were 4,000,000 tons of commercially available capacity idle. Steel mills were more fully employed during 1913 than were the blast furnace plants but even with that factor in mind, it is probable that there were fully 2,750,000 tons of idle steelmaking capacity during 1912.

Increases of open-hearth capacity made during 1913 as given in THE IRON TRADE REVIEW of Jan. 1, 1914, totaled 3,120,000 tons. Adding both the new and idle capacity to the average production of 31,250,000 tons gives a figure somewhat in excess of 37,000,000 tons but as some of the new capacity

was employed during 1913 it is evident that on the opening of this year, the country's capacity was practically 37,000,000 tons.

As shown in the accompanying table, additional capacity placed in operation during 1914 totaled 747,000 tons. The country's steelmaking capacity, therefore, can be placed safely at 37,500,000 tons.

The answer to the question asked in the opening paragraph rests in these figures. The margin between capacity and high record production in the case of steel is 6,250,000 tons; in pig iron, 4,000,000 tons. Open-hearth capacity now under construction and in some cases practically completed totals 1,750,000 tons, increasing the safety factor to 8,000,000 tons. Three blast furnaces practically completed will add 400,000 tons to the pig iron capacity. The margin between capacity and prospective demand while not large is apparently ample.

The largest increase in steelmaking capacity made during 1914 was at the Steelton, Pa., plant of the Pennsylvania Steel Co., where two 200-ton Campbell type tilting open-hearth furnaces and one 75-ton stationary furnace were placed in operation. Of the 43 furnaces listed as under construction, 37 were in process of building at the close of 1913. Some of these were completed during 1914, but owing to market conditions were not placed in operation.

The past year in failing to witness the addition of a new blast furnace set a record that probably has not been approached for years. The three furnaces under construction at the close of 1913 were unfinished at the close of this year, although the new stack of the Bethlehem Steel Co. could operate on short notice. The other two furnaces are being built by the Minnesota Steel Co. The following table shows the annual capacity of new blast furnaces completed yearly during the past ten years:

1905	1,292,000
1906	1,135,000
1907	2,065,000
1908	1,188,000
1909	1,930,000
1910	1,794,000
1911	565,000
1912	1,000,000
1913	550,000
1914	.....

Three additional furnaces were under construction at the close of 1914, two at the Cleveland works of Corrigan, McKinney & Co. and one at the Steelton plant of the Pennsylvania Steel Co. The Woodward Iron Co. replaced its old No. 1 furnace, with a rated capacity of 100 tons daily with a new 450-ton furnace. Among other companies which reconstructed blast furnace plants during the year were the Carnegie Steel Co., Wisconsin Steel Co., Marting Iron & Steel Co., Andrews & Hitchcock Iron Co., Cambria Steel Co. and Maryland Steel Co.

In electric steel furnaces, the United Steel Co., Canton, O., placed in operation a 6-ton Heroult furnace. The installation of a 10-ton Girod furnace at the plant of the Bethlehem Steel Co. is practically completed. The installation of two 20-ton Frick furnaces at the work of the American Iron & Steel Mfg. Co., Lebanon, Pa., is still under way.

Accepts Memorial Plans

Plans for the McKinley memorial at Niles, O., by McKim, Mead & White, have been accepted by the National McKinley Birthplace Memorial Association, of which J. G. Butler Jr., Youngstown, O., is president. The jury of award were: Edgerton Swartout and Charles A. Platt, of New York City, and Edward B. Green, of Buffalo, N. Y., with Dr. Warren P. Laird acting as advisor. It is estimated the building, when completed, will represent a cost of $200,000, exclusive of the bronze statue of McKinley, which is to be placed at the entrance, the award for the design of which is yet to be made.

Buys Bridge Works

O. D. Oakey, proprietor of the Camden Iron Works, Salem, Va., has purchased the entire plant and property of the Roanoke Bridge Co. at Roanoke, Va. The works of the bridge concern was put up at auction on forced sale. The total price paid was $44,949, which figure was considered low, the former owners having paid $135,000 and the property having been appraised at $90,000. Mr. Oakey probably will enter the bridge building field, in connection with the structural steel and jail building business.

Opens New England Office. — The Debevoise-Anderson Co., 56 Liberty street, New York, will open a New England office in the Exchange building, Boston, Jan. 1, which will be in charge of C. A. Wyatt, formerly of Rogers, Brown & Co. The company will offer Buffalo, eastern Pennsylvania and Virginia pig iron, as well as foundry, smelting and crushed coke.

The Cambria Steel Co., Johnstown, Pa., has filed plans for a 2,110-foot slag wall along the east bank of the Conemaugh river. The wall will be built to give more room for plant extensions.

Cotton Tie

Shipments to Cotton Growers Have Been Normal

Despite depressed financial conditions in the south, and the difficulty of moving crops, cotton growers apparently have been baling their product as usual. At least, demand for cotton ties has been normal, manufacturers at Pittsburgh advise. Government reports show that this year's crop will exceed that of 1913 and cotton tie manufacturers appear to be benefiting accordingly.

The bulk of the cotton tie tonnage rolled at Pittsburgh has been shipped to the south. One manufacturer reports at least 95 per cent of the total tonnage rolled in western Pennsylvania already has been delivered. Unless considerable cotton is left to decay in the fields, the season's output of ties will be consumed.

Government reports indicate that approximately 12,000,000 bales of cotton are produced annually in the south. About 2,400,000 bundles are required to handle the average cotton crop. This year, government reports indicate that 16,000,000 bales of cotton will be produced in the south; it is estimated 3,200,000 bundles will be required to handle the crop. Ordinarily about 300,000 bundles of second-hand cotton ties are used.

While demand for cotton ties has been satisfactory, yet material has been selling at decidedly low figures. Foreign manufacturers threatened to play an important part in the market before the season's price was announced by the Carnegie Steel Co., on June 29, last. To eliminate foreign competition, the July price of ties was established at 65 cents a bundle of 45 pounds.

Under normal conditions, the cotton tie market automatically advances one-half cent a bundle on the first day of each succeeding month, but the bulk of the tonnage sold this year has been on the basis of 65 cents a bundle. In 1913, it will be recalled, this product was established on the basis of 80 cents a bundle at the opening of the season; in 1912, makers obtained 70 cents and above per bundle. Not many years ago, cotton ties commanded as high as 95 cents a bundle.

According to data submitted the government in 1913, when a cotton tie famine threatened, cotton ties are furnished by three northern and two southern manufacturers. The Carnegie Steel Co., which supplies the greater portion of the tonnage, rolls about 1,500,000 bundles in normal years.

Business News from the Capital

Important Questions Will Be Considered at Annual Meeting of Chamber of Commerce of the United States

Washington, Dec. 29.—The Chamber of Commerce of the United States, through the current issue of *The Nation's Business,* says it is expecting a full attendance at its annual meeting to be held at the New Willard hotel, this city, Feb. 3, 4 and 5, when delegates will be called upon to consider the most critical national questions now confronting the commercial interests of the nation. A considerable part of the program, it is pointed out, will be devoted to foreign trade, the elimination of undue restriction, the upbuilding of the merchant marine and the aid that can be rendered by the federal reserve board. Recently enacted business legislation will be thoroughly discussed in all its constructive and restrictive aspects.

Report on Export Trade.

Ranking among the most important matters to be taken up is the report of the special committee of the national chamber on trust legislation as to the proposed combination of business interests in export trade. This committee is comprised of R. G. Rhett, chairman; Charles F. Mathewson, George Rublee, W. L. Saunders, Henry R. Seager, Guy E. Tripp and Charles R. Van Hise. The report has been submitted to the chamber's board of directors and by mail vote a majority of the board has authorized its immediate publication and its submission for action to the annual meeting in February. The chamber may at the meeting act finally on the report or order it submitted to the organization members for referendum vote.

Comment made last week by President Wilson as to the proposed amendment to the Sherman anti-trust law permitting combinations in this country to build up its export trade was taken to indicate that he is not in full sympathy with the plan at this time, but rather prefers to wait until the federal trade commission, yet to be appointed, has made an investigation as to trade conditions in and with foreign countries where combinations exist and reported its findings to congress. The chamber's board, however, asserts that the situation affecting the foreign trade of the United States, created by the unexpected war in Europe, gives the ground for urging immediate action rather than waiting for investigation and report by the federal trade commission.

The committee sets forth the principles which it thinks should be embodied in the proposed bill. They provide four distinct points. The first calls for the inclusion in the bill of "All combinations entered into or carried on in good faith for the sole purpose of increasing, facilitating or benefiting export trade, including agreements, transactions and acts entered into, performed or carried out in the course of export trade, which do not restrain or monopolize or tend to restrain or monopolize trade within the United States shall be lawful." The second principle is that the term "export trade" should be confined to trade or commerce from the United States to any foreign nation; and the term "foreign nation" should not include any of the insular possessions of the United States. The third principle sets forth that the federal trade commission should have the same control over the proposed export combinations where it has reason to think restraint of trade or monopoly is involved that it has over domestic trade with regard to unfair methods of competition. The fourth point holds that none of the powers conferred upon the federal trade commission should be in any way abridged in such a bill.

The special committee states that reasons heretofore given for such combinations still hold at the present day under the new conditions created by war and will acquire a far greater significance when the nations at war, whose foreign trade has been curtailed, again enter into active competition for foreign markets. It is pointed out that foreign countries have combinations such as the committee recommends for this nation as a matter of protection. The committee says it does not see how the interests of exporters of American products could be in any way injured by permitting a combination of sellers provided the federal trade commission is given full power to prevent unfair practices, detrimental to the interests of any American producers and also to prevent any action by such combinations which tend to restrain trade or promote monopoly. It is pointed out also that the smaller American manufacturer in attempting to secure a foreign market and in order to take advantage of the foreign trade opportunity created by the war, together with the larger firms and corporations already established in foreign trade, must be permitted to cooperate with his fellows in like lines of production in supporting a common selling agency. He would consequently enter into agreements as to distribution, both of expenses and of profits. It is cited that, while it is not clear today precisely to what extent existing anti-trust laws would prevent such arrangements entered into in good faith, it is more than apparent that under the laws as they stand American manufacturers are afraid to combine to enter the foreign field and that if this condition is not remedied, the United States will not begin to take full advantage of present foreign trade opportunities. It is to settle such doubts, as well as to obviate any actual unreasonable restrictions in existing anti-trust laws which may apply to foreign trade, that the committee recommends prompt action by the chamber along the lines it indicates in its report.

The committee asserts that the sole grounds of opposition to the proposed bill will arise from fear that through permission to combine for export trade some injury may result to American consumers and the smaller American manufacturers. This fear is, in the opinion of the committee, not well grounded, inasmuch as the federal trade commission would be empowered to prevent such injury. The committee lastly sets forth the fact that in the Clayton act congress indicated that so far as the export trade is concerned it has no objection to discriminations in prices and to exclusive agency contracts even though their results may substantially lessen competition or even tend to create a monopoly in a line of commerce.

Doomed to Fail

Washington, Dec. 29.—Inquiry has convinced officials here that the London safety-at-sea convention is doomed to failure. It appears that it will be impossible to complete the exchange of ratifications and give vitality to the treaty because neither Germany, Austria nor Turkey is in a position to send a plenipotentiary to London to sign the technical act affirming the exchange of ratifications. President Wilson is expected to make known

the contents of a legal opinion he has obtained as to what effect the resolution tacked to the treaty by the senate will have on the treaty.

Legislative Outlook

Washington, Dec. 29.—Thoroughly aware that the business world is utterly opposed to an extra session of congress, it is believed the administration is exerting itself to see that such a contingency is avoided. The chance that the European or Mexican war may make necessary an extra session is present, of course, but this appears to be the only element which may prevent congress from adjourning on March 4 until the following regular session in December, 1915. Democrats of the senate have not only discussed in caucus the legislative program with a view to seeing that there is no extra session, but conferences having the same end in mind have been held between the President and majority leaders of congress.

It appears certain, however, that it will be impossible for congress to enact the program laid out by the President in his message for this session. Some of his measures apparently will have to wait until the next session. It is thought that, with the enactment of the immigration, conservation, ship purchase, Philippine and supply bills, along with the ratification of the Colombian and Nicarauguan treaties, the administration would be satisfied for this session. There are, however, unlimited possibilities of extended debate in the senate on every one of the foregoing measures as well as the treaties, and no assurance is evident that this program can be carried through. Furthermore, it is pointed out, that the friction existing between the President and certain members of the senate over the matter of patronage is a handicap which will operate against expedition of the proposed program. Although the President may not feel that the friction prevails and may decry the idea that patronage would be allowed to interfere with important legislation in hand, it is an undeniable fact that some Democratic senators are angry at the President and apparently would not hesitate in holding up the program if they thought they could do so without injuring their own political standing.

None of the supply bills have passed the senate, while three have been enacted by the house. Holiday recess was purposely cut short by congress that it might get completed as much of the proposed as possible, if not all of it. Senator Newlands, chairman of the interstate commerce committee, is desirous of having the Rayburn securities bill, giving the interstate commerce commission control over the issue of railroad stocks and bonds, enacted at this session, but it is not believed he will be able to carry out his plan.

Caution is being exercised more than ever, it seems apparent, not to enact any measures of a possibly harmful nature, and the President has repeatedly emphasized that the business program is virtually complete. The political equation enters largely into the action of the majority in congress in slowing down on legislation. Everything done before midsummer of 1916 will enter into the national platforms of the political parties that year, and influence the result at the ballot box.

The November election denoted that business and laboring interests want prosperity; that what benefits one benefits the other, and Democratic legislation, especially the tariff, was responsible for the big Republican victories. Moreover, labor, as usual, showed it is not unified in its vote. Meaningless labor clauses in the Clayton anti-trust law apparently were sized up by the labor element generally as being a mere sop and it is doubtful whether they netted any votes for the party having them enacted. Approval by the American Federation of Labor of the clauses did not prevent individuals affiliated with that organization from voting independently of their leaders' suggestions.

Big Saving for Shippers

Detroit, Dec. 22.—Two years of hammering at the railroads entering Detroit has brought results and incidentally a saving of about $200,000 a year for the shippers of this city. After a long fight, engendering much bitter feeling between the carriers and shippers, the roads have abolished the reconsigning charge.

The first to succumb was the Detroit & Toledo Shore Line which issued a tariff effective Oct. 20. It was quickly followed by the other railroads and the battle was conducted mainly by Robert H. Day, manager of the transportation committee of the Builders' and Traders' Exchange.

The Wetzel Mechanical Stoker Co., Trenton, N. J., has received an order to supply many stokers for the Havana, Cuba, plant of J. Lera, Inc., of New York, exporter and engineer. An order is also being filled for the Penn Central Power & Transmission Co., Williamsburg, Pa. The Wetzel plant is very busy at the present time.

Plants Purchased

The Cyrilla and Francis No. 1 plants of the Sunshine Coal & Coke Co., Uniontown, Pa., were purchased by the American Steel Co., Park building, Pittsburgh, at a public sale, Dec. 16, for approximately $300,000. Operation will be resumed early next year.

The Cyrilla plant, located at Lynn station, Redstone township, consists of about 180 acres of Pittsburgh coal, 157 acres of surface, 142 beehive ovens, and complete coke plant equipment.

The Francis No. 1 plant, located at Martin, Nicholson township, includes 120 acres of Pittsburgh coal, 330 acres of Sewickley coal, 475 acres of surface, 240 beehive ovens, and other equipment necessary for the operation of the plant.

The American Steel Co. is interested in several coke plants and has been selling furnace and foundry grades for several years.

Busy Oakley Plant

One of the busiest factories in the Oakley factory colony, a suburb of Cincinnati, is the H. L. Brown Fence & Mfg. Co., manufacturer of high grade ornamental woven wire lawn fence, tree guard, flower bed borders and other artistic designs for the lawn. This company has recently employed a special designing engineer to improve the machinery and put in additional machines which will enable it to turn out the very best ornamental woven wire fence that can be produced, and make it especially desirable for the jobbing trade. The plant will handle its entire output through the wholesale hardware jobbers. It is well located to take care of the business, having a large, fireproof structure and private railroad siding. The plant is now running full time.

Harmony Club.—The second annual meeting of the Harmony Club of the J. M. & L. A. Osborn Co., Cleveland, formed to promote the welfare of the company, was held at the Hotel Statler the first three days of this week. A dinner for members and ladies was given Monday evening and a dinner for members Tuesday evening. Business sessions were held Monday, Tuesday and Wednesday and topics of interest to the company discussed.

The plant of the Aluminum Co. of America, at New Kensington Pa., has received an order for 500,000 canteens for shipment to the Allies, according to a report from that city.

Improvements

Made at Works of Bethlehem Steel Co. During Past Year

During 1914, a great deal of construction work was in progress at the two plants of the Bethlehem Steel Co., South Bethlehem, Pa., but about Aug. 1, it was entirely suspended owing to existing commercial conditions, and has not as yet been resumed.

At the Lehigh plant blast furnace "C", which was dismantled, has been rebuilt along modern lines, and equipped with an electric skip. The product of this furnace has not been needed, and the furnace has not been put into service. Work is practically completed on the 35-inch reversing blooming mill, together with the soaking pits, gas producers, stripper, etc. The 18-inch Morgan continuous mill, four-stand 22-inch round mill, and 16-inch and 12-inch mill, 12-inch and 8-inch combination mill, and the 10-inch guide mill, are practically ready to operate. The motors for these mills have all been received and partially wired. The treatment department for alloy bars, and the finishing end, which includes straighteners and cold drawing equipment, was also well under way when work was suspended.

When completed, these mills will represent a high type of construction. The buildings are of brick, with steel sash and concrete roofs, and will be paved with brick. Electric drive is used throughout. The mills themselves are of heavy construction and are especially designed for rolling alloy steel bars. No wood is about the mills.

Plans are fully developed and some work has been done on rebuilding the puddle-mill and its building. The plans include replacing the steam engines with electric motors. In the crucible department, plans are completed, and some material is on the ground for a new 16-inch and 12-inch and a new 12-inch and 8-inch mill for handling crucible products. These mills will be motor-driven, and equipped with heating and annealing furnaces. Equipment has been purchased for this department for drawing high speed drill rods, and it will be installed in a short time.

The six open-hearth furnaces, which were begun last year, to furnish additional steel for the above mills, were well under way when the suspension was ordered. They will be heated with producer gas from Hughes producers, two producers to be provided for each furnace. The 10-ton Girod electric furnace is completely installed and practically ready to operate.

A contract has been let for a new safety and welfare building, to be equipped for first aid work and to provide quarters for the safety and welfare department. The brass foundry has been extended to provide approximately twice as much floor space. In the drop forge department, work is progressing on a new system of blowers and oil and blast piping for the heating furnaces. A number of machine tools have also been added to the equipment of this department.

To the departments devoted to the manufacture of ordnance, a number of extensions and additions have been made, or are in progress of construction. Two additional stories have been added to the projectile machine shop, and additional machine tools installed. A number of hydraulic presses and additional treating equipment has been provided. In the machine shop, which is used for the manufacture of small guns and field carriages, and other field equipment, additional stories are being added and additions being made, which will result in a considerable increase in floor space. Additions have been made to the machine tool equipment.

In order to supplement and round out the ordnance products of the Bethlehem company, a fuse plant is being erected at Redington, five miles distant from the main works. A powder plant has been authorized to be located at Newcastle, Del., and a cartridge case plant at Bethlehem. The plans are well under way for these two departments, and the plants themselves will be pushed to completion. The proving grounds at Redington, which are used for the proving of all guns up to 14 inches, have been entirely rebuilt, new foundations and tracks installed, and a new 125-ton electric crane installed for handling the guns and mounts from the cars to their firing positions. This puts the proving grounds in condition for proof-firing guns of all sizes.

At the Saucon plant, an addition to the pumping station has been completed, and a 20,000,000-gallon motor-driven centrifugal pump put in operation. A number of waste heat boilers have been installed at the open-hearth plant, and also over the heating furnaces at the 28-inch structural mill.

May Purchase Plant.—The Pratt & Whitney Co., Hartford, Conn., has put in an offer to purchase the Hartford plant of the Pope Mfg. Co., which for some time has been in the hands of a receiver. It is the opinion of Col. Geo. Pope, receiver, that the offer will be acceptable to the court. The Pope plant at Hartford consists of 24 buildings, valued at $634,375, by the receivership appraisers and the land value was put in at $84,750. The assessed valuation of the property in 1913 was $500,000, for both land and buildings. The property adjoins the Pratt & Whitney plant on the west.

Chains for War

Both the John A. Roebling's Sons Co. and the Woodhouse Chain Works, Trenton, N. J., are filling large war orders for English and French governments. The Woodhouse company is making various sizes of chains, while the Roebling company is making 100,000 sets of gun carriage steel trace chains, of eight to a set, making a total of 800,000 chains. The plant recently took back several hundred men who were laid off some time ago. The product is being shipped to Canada.

Obituaries

Christopher M. Graham, for many years employed by the Westinghouse Air Brake Co., Wilmerding, Pa., died last week. He was 68 years old.

Charles H. Semple, vice president and director in the Beck & Corbett Iron Co., St. Louis, died early Christmas of anemia at his home in St. Louis.

Charles C. Headrick, said to be the oldest employe in point of service at the Cambria Steel Co. works at Johnstown, Pa., died recently. He was 70 years old.

Richard Martin, president of the Vilsack-Martin Co., Pittsburgh, manufacturer of ornamental iron, died at his home in Oakmont, Pa., Dec. 27. He was 63 years old. Mr. Martin was born in Scotland, June 30, 1851, and went to Pittsburgh in 1883. For the last 25 years he had been engaged in the ornamental iron business.

At the recent annual meeting of the Blystone Mfg. Co., Cambridge Springs, Pa., officers for the ensuing year were elected as follows: W. J. Pees, president; Dr. C. L. Smith, vice president; Luther G. Conroe, treasurer and general manager; H. J. Le Fevre, secretary and manager of sales. The directors follow: J. A. Boland, W. J. Pees, Luther G. Conroe, Dr. C. L. Smith, F. A. Wildman, J. F. Mather and H. J. Le Fevre.

The Affiliated Manufacturers' Co., representing several large Milwaukee machinery and engine interests, has received an order for $10,000 worth of small gasoline engines for shipment to Australia. The order was received through Richardson, Orr & Co., New York, the company's foreign representative.

Domestic Business is Better

While Machine Tool Builders Are Busy Filling War Orders the Home Market is Slowly Improving

War and Peace Make Ten Inquiries

The general contract for reconstructing the plant of Thomas A. Edison, Inc., West Orange, N. J., recently damaged by fire, has been awarded to the Moyer Engineering & Construction Co., 375 Fulton street, Brooklyn, N. Y.

Richardson & Boynton Co., Dover, N. J., which is building a plant to replace that recently wiped out by fire, is expected to put out a list of machine tool requirements some time after Jan. 1.

Lima Locomotive Corporation and the Ohio Steel Foundry Co., Lima, O., which issued lists of machine tools last summer, are not expected to take action on these requirements until some time in the spring.

Remington Arms Co., Ilion, N. Y., is making inquiries for a large number of machine tools for a large addition it is building.

Hydraulic Turbine Co., Camden, N. Y., recently incorporated, will take bids in about a month for construction of a 50 x 300-foot building, with a 50 x 300-foot wing. Isaac D. West, Camden, is general manager and treasurer.

Arthur E. Mueller, of Mueller & Martin, Louisville, Ky., has information regarding a $400,000 office and bank building, to be erected at Fifth and Jefferson streets, Louisville, Ky.

Traylor Engineering & Mfg. Co., Allentown, Pa., which is figuring on a shrapnel contract, has inquired for 50 turret lathes, to be used on 3¼-inch stock.

A 13-story hotel will be erected at Broad, High and Wall streets, Columbus, O., early in 1915, and will be known as the Deshler hotel. It will be 108 x 187 feet, 160 feet in height from the sidewalk, and the basement will extend 40 feet below the surface of the street. The building will be of steel construction.

Harrisburg Pipe & Pipe Bending Co., Harrisburg, Pa., recently put out inquiries for machine tools, in connection with a shrapnel contract on which it has been figuring.

A site has been purchased and a technical high school building, to cost approximately $1,000,000, will be erected by the board of education, at Madison road and Erie avenue, Cincinnati, work to begin some time in 1915.

THE eastern machinery market was very quiet during the holidays, but the feeling is cheerful and favorable developments are expected after the first of the year. No inquiries which have been previously reported have been closed. Among other recent developments, the Traylor Engineering & Mfg. Co., Allentown, Pa., has inquired for 50 turret lathes and other equipment for making shrapnel. The New York Air Brake Co., which took bids some time ago on approximately 100 tools to make shrapnel on a very large contract has not yet closed for its requirements.

In Cincinnati, the machine tool business at the present time presents a very different aspect than is the usual custom at this time of the year. In December both manufacturers and buyers are usually taking inventories and business is generally postponed until after the first of the year. However, this year heavy orders received from European countries engaged in the war are keeping local makers of lathes and radial drills, and in some cases planers, running full force with occasionally night shifts. Several plants here have enough orders on hand to keep them busy until March 1. Business also continues to pour in from Europe. The Cincinnati Iron & Steel Co. last week shipped two carloads of 18-inch lathes to England, and during the week of Dec. 14 received an order for two carloads of 14, 16 and 18-inch lathes from Italy, this being the third order that this company has received from the same source within the past four months. The Cincinnati Iron & Steel Co. has also recently received domestic orders from six points in the United States, scattered throughout the eastern, western and northern parts of the country. A large inquiry still is pending from Russia for lathes for quick delivery. Demand for shapers and woodworking machinery continues at a low ebb.

At Pittsburgh, the market for machine tools and rolling mill equipment is experiencing the usual holiday lull, and dealers do not expect any change in the situation until the end of the first fortnight in January. Despite the inactivity caused by the holiday season, December is described by most sellers as a much more satisfactory month than November. The New York Central system, it is unofficially announced, contemplates the erection of a roundhouse and car repair shops near Youngstown. While machine tool dealers do not hope to benefit immediately as a result of the advances allowed in railway freight rates, yet they believe trunk line carriers will buy quantities of needed equipment shortly after the opening of the new year.

The Chicago machine tool market is feeling the holiday quiet and no impetus yet has been received from the railways. Demand is slacker than in the past. A list expected from the North-Western railway has not yet been issued. Several small deals which have been hanging fire for months have been closed recently, indicating a better sentiment.

EASTERN STATES

PORTSMOUTH, N. H.—It is expected the Boston & Maine railroad will replace its machine shop, destroyed by fire Nov. 23, by a smaller structure.

MONTPELIER, VT.—Ithiel Falls Power Co. has been incorporated; $150,000 capital stock; by Bancroft Abbott, Norwood, Mass.; Frank A. Walker, Barre, Me.; Charles H. Thompson and Benjamin A. Summer, both of Montpelier.

BOSTON.—Jos. B. Palmer, 333 Rutherford avenue, Charlestown, has let contract for the construction of a two-story and basement, 50 x 60-foot plant, to be used for manufacturing carriage springs.

SALEM, MASS.—Architects Heven & Crosby 40 Central street, Boston, have thrown out bids for a four-story and basement, 35 x 213-foot plant, to be erected for Wm. H. Gove, 254 Lafayette street, Salem, plans are being revised.

The above shows an installation of Ayer & Lord Interior Wood Blocks in the plant of a large manufacturer of **Pumps, Engines, Oil Well Supplies,** etc.
The previous floor of brick was completely worn out under the severe service.
There is considerable trucking in this room. Note the heavy loads set on pedestals.
The level of the floor is not affected.

We Congratulate You!

We congratulate you that you have begun the New Year right!

We congratulate you that **YOUR** sound judgment has proved **identical** with the sound judgment of many of the most **up-to-date** and **prosperous** concerns of their kind in the country.

We congratulate you that you have taken the **most important** step toward the elimination of your flooring troubles—**delays, expenses, accidents!**

We congratulate you that your selection has led to an installation of **Ayer & Lord Interior Wood Blocks.**

Tell your friends to write for our little booklet "FLOORS."

AYER & LORD INTERIOR — Always Easy on the Feet — WOOD BLOCKS

Ayer & Lord Tie Company

General Offices, Railway Exchange, Chicago

CLEVELAND, O.—801 Swetland Bldg.
KANSAS CITY, MO.—1117 Rialto Bldg.
MEMPHIS, TENN.—1402 Exchange Bldg.
PHILADELPHIA, PA.—319 Perry Bldg

Say you saw it in THE IRON TRADE REVIEW

SOMERVILLE, MASS. — Somerville Iron Foundry, owned by N. H. Reed & Son, was damaged to the extent of $600 by fire on Dec. 20.

WORCESTER, MASS. — Wheeler Foundry Co., Inc., plans to build a shop early in the spring; Arthur Miller, general manager.

GROTON, CONN.—New London Ship & Engine Co. has let contract for one-story, 46 x 118-foot machine shop, and construction work has begun.

NEW HAVEN, CONN.—Winchester Repeating Arms Co. has let to Westinghouse, Church, Kerr Co., 37 Wall street, New York, the ground contract for three new buildings, 53 x 161 feet, 58 x 208 feet and 67 x 89 feet, respectively.

STAMFORD, CONN.—Elm Refining Co. has let contract for one-story, 30 x 80-foot building.

BUFFALO.—Contracts have been let for the construction of a four-story, 40 x 115-foot plant, for the Robertson Cataract Electrical Co.

BUFFALO.—United States Rubber Reclaiming Co., in which C. B. Brewster, 724 Babcock avenue, is interested, is planning to put up a $50,000 plant.

ILION, N. Y.—Remington Arms Co. has quietly put out inquiries for a large number of machine tools for the large addition it is building.

NEW YORK.—Millbrook Woolen Mills, textiles, has been incorporated; $100,000 capital stock; by E. and A. A. Kaplan, H. I. Sager, 64 East 122nd street.

NEW YORK.—Balloffet Baszanger Die Co., Inc., has been incorporated; $10,000 capital stock; by Charles E. Gay, Walter H. Aspinwall, Arthur K. Wing; Wing & Wing, attorneys, 27 Cedar street.

NEW YORK.—Bauer Chemical Co., 30 Irving Place, has let contract for construction of two-story, 45 x 62-foot, and one-story, 42 x 82-foot, plant, also for one-story, 44 x 45-foot power house, to be erected at Oneonta, N. Y. Food products will be manufactured.

NEW YORK.—New York Air Brake Co. for several weeks has been figuring on a shrapnel contract involving 8,000,000 shrapnel at $7.50 to $8 apiece; the company has received bids on about 100 machine tools which will be bought if the contract is closed.

NEW YORK. — Beverage Machine & Bottle Co. has been incorporated to manufacture brewers' supplies, etc.; beverages, soft drinks, etc.; $500,000 capital stock; by A. K. Evans, Guelph, Ont., Canada; C. E. Culpeper, New York City; H. D. Nims, Bronxville.

PORT CHESTER, N. Y—Plans have been prepared by Samuel M. Green & Co. for the erection of a $25,000, two-story plant for the Commercial Research Co., Tuckahoe, N. Y., on Midland avenue, for the manufacture of platinum for tungsten lights, etc.

SYRACUSE, N. Y.—H. E. Hessler Co., 512 North Salina street, manufacturer of sheet metal stampings, will build a two-story, 35 x 80-foot addition.

UTICA, N. Y.—Hydraulic Turbine Co., recently incorporated, will take bids in about one month, for construction of a one-story, 50 x 300-foot building, with 50 x 300-foot wing, at Camden, near here; Russell S. Johnson, City National Bank building, is president; Wm. E. Lewis, Utica, vice president, and Isaac D. West, Camden, general manager and treasurer.

ALLENTOWN, PA.—Traylor Enginering & Mfg. Co., which is figuring on a shrapnel contract, has inquired for 50 turret lathes, to be used on 3¼-inch stock.

BEDFORD, PA.—The borough of Bedford will build a sewage disposal plant, plans for which have been prepared by C. E. Collins, engineer, Philadelphia.

BRIDGEPORT. — Philadelphia & Reading railroad, has let contracts for roundhouse alterations here.

GROVE CITY, PA.—Bessemer Gas Engine Co. is arranging to take over the Bessemer Foundry Co.'s plant here Jan. 1; Harry Poet of the Bessemer Gas Engine Co. will succeed Mr. Christy as superintendent.

HARRISBURG, PA.—Harrisburg Pipe & Pipe Bending Co., recently put out inquiries for machine tools, in connection with a shrapnel contract on which it has been figuring.

IRWIN, PA.—The plant of the Penn Electric Co. was badly damaged by fire Dec. 24, causing a loss of $40,000; owners will rebuild; F. D. Hockensmith, Pittsburgh, W. F. O'Neil, Pittsburgh, and D. M. Wagoner, Irwin, control the plant.

JOHNSTOWN, PA.—Johnstown Rubber Co. will increase its capital from $25,000 to $100,000; the company is negotiating for a new site at Morrellville, Pa.

LEBANON, PA.—Columbus Chain Co. has completed plans for an addition to its plant.

NEW CASTLE, PA.—City council is considering several sites for the erection of a new sewage disposal plant; City Engineer Milholland has plans.

NEW CASTLE, PA.—Empire Equipment Co. has been organized to deal in automobiles, motors, machines and miscellaneous equipment; those interested include: Karl S. Turner, Clyde A. Bach, Ira W. Darby, and others, of this city.

PARKERS LANDING, PA. — Wightman Glass Co. buildings have been purchased by a number of citizens who will install bottle manufacturing equipment; a bond issue of $20,000 will be made to make the necessary improvements.

PHILADELPHIA.—E. Allen Wilson is preparing plans for Bayuk Brothers, for a four-story, 90 x 100-foot factory to be erected at New Brunswick, N. J.

PHILADELPHIA.—Jacob Hornung has let contract to Philip Haiback Contracting Co., for a two-story and basement, 36 x 60-foot machine shop, on Twenty-second street, north of Clearfield avenue.

PITTSBURGH. — Gem Mfg. Co., which is erecting a new plant on the North Side, has increased its debt $25,000.

PITTSBURGH.—The board of education of Aspinwall, a suburb, plans to erect a $5,000, brick high school building.

PITTSBURGH. — The contract for the elliptical arch reinforced concrete bridge over Pine creek in Shaler township has been awarded the Pitt Construction Co.

PITTSBURGH.—Jones & Laughlin Steel Co. has purchased from the city one and seventenths acres, formerly the property of the Monongahela Water Co., for $73,961, for future extensions.

PITTSBURGH.—Fire swept the plant of the Superior Steel Co., at Carnegie, a suburb, Dec. 25, doing damage to the shipping and annealing departments; damage is estimated at $100,000; officials plan to rebuild.

PITTSBURGH.—A five-story brick, stone and terra cotta building will be erected for the school of design, Carnegie Institute of Technology; Henry Hornbostle, building bureau, Carnegie Institute of Technology, has detailed plans.

SCRANTON, PA.—Albert J. Ward, Republican building, is drawing plans for a motor-car factory; the owner's name is not announced.

UNIONTOWN, PA.—Whyel Coal Co. has taken out a West Virginia charter to engage in coal mining; capital is $250,000; the incorporators are George Whyel, Harry Whyel, H. L. Robinson of this city and F. E. Waddell of Scottdale, Pa.

WILKES BARRE, PA.—Henry Meier, coal exchange building, is drawing plans for Solomon Heller, for a three-story, 42 x 52-foot factory and garage, to be built next spring.

YORK, PA.—York Corrugated will build a $22,000 two-story, brick factory building.

DOVER, N. J.—Richardson & Boynton Co., which is building a plant to replace that recently wiped out by fire, is expected to put out a list of machine tool requirements some time after Jan. 1.

JERSEY CITY, N. J.—Steel Enameling & Mfg. Co. has been incorporated; $250,000 capital stock; by Thomas S. Baker, H. S. Stewart, New York City; A. A. Kelly, Montclair, N. J.

JERSEY CITY, N. J.—Jersey City Construction Co. has been incorporated; $25,000 capital stock; by Owen F. Langan, James J. Higgins, Jersey City; Parker Bentley, New York.

NEWARK, N. J.—Essex Specialty Co., manufacturer of toy novelties, has been incorporated; $100,000 capital stock; Benedict Wolf, Fannie Wolf, Newark; Milton M. Adler, Brooklyn.

NEWARK, N. J.—Morris Herrmann & Co., whose plant recently was burned will build immediately a two-story brick factory, 50 x 150 feet.

PERTH AMBOY, N. J.—H. W. Schrimpf, contractor, has been awarded the contract for a steel bridge across the Lehigh railroad tracks at $33,779.

TRENTON, N. J.—Old plant of the American Lamp & Brass Co., Mulberry street, has been sold to the Mecca Tire Co., Philadelphia, which will make several alterations to the plant.

TRENTON, N. J.—The coming legislature will be asked to build a state prison at Rahway and abandon the one in Trenton; proposed structure will be of stone and steel and will accommodate about 2,000 convicts; several workshops are included in the plans.

TRENTON, N. J.—New Jersey & New York Bridge Association has been incorporated, with headquarters at Bergenfield, N. J., for the erection of a bridge across the Hudson river, connecting New Jersey and New York; J. Wilkes O'Neill, W. M. Cornell, and Milton Jones, all of Bergenfield, N. J.; Thomas R. Clendinen, Fort Lee, N. J., et al., trustees.

WASHINGTON, PARK, N. J.—Wm. Steele & Sons, Philadelphia, have prepared plans for a five-story, 250 x 500-foot factory for the Campbell Soup Co., at Camden, N. J.

WEST ORANGE, N. J.—General contract for reconstructing plant of Thomas A. Edison, Inc., recently damaged by fire, has been awarded to the Moyer Engineering & Construction Co., 375 Fulton street, Brooklyn, N. Y.

BALTIMORE.—Prudential Oil Corporation, 17 Battery place, New York, may build $500,000 oil refinery here. Plans as yet are very preliminary.

BALTIMORE.—Kennedy Foundry Co., Joseph P. Kennedy, president, has under consideration plans to build a one-story foundry at Charles and Wells streets, to cost in the neighborhood of $100,000.

KENSINGTON, MD.—Town will receive bids until 8 P. M., Jan. 15 for the construction of a water works and sewage system, costing about $50,000; plans include about five miles of 4, 6 and 8-inch water mains, pumping station, etc.

WASHINGTON, D. C.—The assistant secretary of the department of the interior will take bids until Jan. 15 for boilers for the government hospital for the insane at Anacostia, D. C.

WASHINGTON, D. C.—Bureau of yards and docks, navy department, will take bids until Jan. 5 for lathe dogs, and hoists and trolley for handling 14-inch shells, for the Brooklyn navy yard; for 24-inch, 14-inch and 16-inch swing lathes, universal milling machines, and a wire fed screw machine for the Washington navy yard; till Jan. 9 for one 15-ton locomotive crane for the Boston navy yard; till Jan. 23, for two 15-ton locomotive cranes, for the naval station at Pearl Harbor, Hawaii.

Established 60 Years

THOMAS

1854 PIG IRONS 1914

THOMAS

Experience——Service——Reputation——Quality

THE HUMAN SIDE of

"Thomas-Vanadium" Irons—I.

With every charge of iron ore, coke and limestone made in our furnaces is mixed the ripened experience of a large, harmonious organization. The period of employment of the nestor of this force dates back over a period of 50 years and many of the officials and department heads have supervised the production of every ton of Thomas Irons for periods varying from 25 to 40 years.

As the ranks have thinned new blood, skilled in the more modern iron producing practice, has been added, thereby maintaining at its highest efficiency the organization that stands behind Thomas Irons.

THE HUMAN REPORT

At the recent annual meeting of the American Society of Mechanical Engineers, retiring President James Hartness directed attention to the value of a human report of every company's operations which he said should receive the same degree of attention as the treasurer's report. To quote Mr. Hartness:

"The human report would cover the entire organization and would contain a statement regarding the elements of harmony of organization; of length of service of manager and workers; the frequency of changes of all kinds in the business, the efficiency of each man, etc. The investor who considers this human rating with the treasurer's statement seldom will make a mistake in estimating the true worth of an industrial organization."

The acid test of the Human Report can be applied successfully to the Thomas organization, and harmony, length of service, efficiency of employes, etc., is reflected in every ton of its product.

The consumer of pig iron who considers this human rating will not make a mistake in the purchase of "THOMAS-VANADIUM" irons.

In our next advertisement, to be published in the "America First" number of THE IRON TRADE REVIEW, Jan. 7, 1915, we will make a human report of the Thomas Iron Co. and to this can be attributed the high quality and constantly maintained uniformity of "THOMAS-VANADIUM" pig irons.

THOMAS IRON CO. HOKENDAUQUA, PA.

Quality since 1854

The Thomas Iron Co.

Manufacturers of Foundry, Forge, Malleable, Basic and "THOMAS-VANADIUM" Pig Iron

General Sales Office: EASTON, PENN'A.

Philadelphia: 628 Stephen Girard Building
New York: 90 West Street Boston: Exchange Bldg., 53 State Street

CENTRAL STATES

ASHLAND, O.—Ashland Foundry Co. has increased its capital from $20,000 to $32,000.

BELLAIRE, O.—Rodefer Glass Co., manufacturer, has been incorporated; $300,000 capital stock; by C. M. Rodefer, C. R. Harmon, C. W. Lancaster, J. M. Weeks, A. M. Rodefer.

BREWSTER, O.—Village clerk will receive bids until Jan. 2 for $21,000 bonds for the construction of a water works.

CANTON, O.—H. L. McKenzie, head of the Canton Corrugating Co., announced the company is planning an addition and a considerable amount of new machinery for the coming year.

CINCINNATI.—Heekin Can Co. has purchased a lot 28 x 88 feet adjoining its plant on Sixth street near Broadway; the company is contemplating building an addition.

CINCINNATI. — Contracts for ice making equipment will be let shortly by Maescher & Co., Cincinnati, who will build an addition to their plant.

CINCINNATI.—Some light equipment for an automobile repair shop will be needed by E. H. Jungclas, Reading and Paddock roads, Cincinnati, who has let the contract for a large public garage building.

CINCINNATI. — A technical high school building, to cost approximately $1,000,000, will be erected by the board of education, at Madison road and Erie avenue; work will begin some time in 1915; real estate was recently purchased for $90,000.

CINCINNATI.—An eight-story building will be erected at the southwest corner of Sixth and Sycamore streets early in 1915, by Val Duttenhoefer, of the firm of Val Duttenheofer & Sons Co., Cincinnati; the building will be 90 x 140 feet and will have a frame work of steel; estimates on the cost of construction will be received shortly after Jan. 1.

CLEVELAND.—Voght Mfg. Co., hardware, has been incorporated; $10,000 capital stock; by C. E. Voght, E. O. Loeber, E. D. Morgan, J. S. Craig, F. C. Adams.

CLEVELAND. — Callophone Co., manufacturer, has been incorporated; $25,000 capital stock; by M. E. Jenkins, F. H. Pelton, F. A. Shepard, James A. Ford, R. G. Morrison.

CLEVELAND.—Morgan Lithograph Co., St. Clair and East Third streets, will erect a $100,000 building, 170 x 250 feet, at Payne avenue and East Seventeenth, early in the spring.

CLEVELAND.—F. J. Erney Mfg Co., auto signal lamps, has been incorporated; $3,000 capital stock; by J. H. Folk Jr., A. J. Kasch, J. F. Pavolik, F. J. Erney, A. A. Latton.

CLEVELAND.—Union Building & Improvement Co. has submitted new plans for a six-story, 75 x 112-foot office building to adjoin the Union building in the rear at 1836 Euclid avenue; construction will not commence for some time.

CLEVELAND.—Ground will be broken early in the spring for the proposed $4,000,000 terminal warehouse, to be erected by the West Ninth Street Terminal Co., a company organized by George T. Bishop, A. A. Mudge, Charles Pratt, et al.; in the meantime an engineer will be selected and bids taken; the main building will be eight and ten stories high and will provide 9,000,000 cubic feet of storage space, besides a refrigerating system and 11 tracks.

COLUMBUS, O.—Kropp Shoe Co., incorporated at $150,000, will erect a plant in Columbus shortly; William Kropp, president.

COLUMBUS, O.—A 13-story hotel will be erected at Broad, High and Wall streets early in 1915 and will be known as the Deshler Hotel; it will be 108 x 187 feet, 160 feet in height from the sidewalk and the basement will extend 40 feet below the surface of the street; the building will have a frame work of steel.

LIMA, O.—Lima Locomotive Corporation and the Ohio Steel Foundry Co., which put out lists of machine tools last summer, are not expected to take action on these requirements until some time in the spring.

LOVELAND, O.—Loveland Manufactured Ice & Cold Storage Co. will be in the market shortly for some special machinery, which will be used in a new process for making ice.

MASSILLON, O.—Massillon Desk & Chair Co., manufacturers, has been incorporated; $300,000 capital stock; by David Reed, et al.

OBERLIN, O.—Ohio Road Machinery Co. plans to reorganize with a capital stock of $100,000 and will ask citizens to subscribe for $50,000 worth of stock; information is given that the company desires to increase its business facilities; J. C. Brown, Galion, O., is financing the deal.

SALEM, O.—City council is considering the erection of a municipal light plant; Service Director Russell says suitable generators and other apparatus can be installed for $20,000.

SOUTH NEWBURGH, O.—Village clerk will receive bids until noon, Jan. 30 for the purchase of $4,028 bonds for construction of a water main and laying water pipes.

TIFFIN, O.—Ohio Light & Power Co. has increased its capital from $1,500,000 to $2,000,000.

WOOSTER, O.—Bids will be received soon for a filtration plant which will cost about $140,000.

YOUNGSTOWN, O.—Plans are being prepered by the Youngstown Ice Co. for a large storage building to require a considerable amount of equipment.

YOUNGSTOWN, O.—State utilities commission granted the Mahoning County Light Co. permission of issue $600,000 of 20-year, 6 per cent bonds at not less than par and $400,000 of stock par; Harry Engle, secretary-treasurer.

ZANESVILLE. — Burton - Townsend Brick & Fuel Supply Co. will erect an addition to its plant; N. D. Dodd and L. R. Brown, engineers, have plans.

BAKER, W. VA.—Baker Lime Co., capital $5,000, has been organized to operate lime quarries, by C. C. Wise, Rio; L. L. Linl, Lost River; W. H. Warden, Wardensville, W. Va., and others.

CHARLESTON, W. VA. — Roche - Bruner Building Co., Cincinnati, O., has been awarded the general contract for a high school building in Charleston.

CLARKSBURG, W. VA. — Artic Ice & Bottling Co., manufacturer of ice, has been incorporated; $75,000 capital stock; by Thomas Connell, William Wanstreet, William P. Coughlin, Edward V. Connell, John A. Tierney,

FAIRMONT, W. VA.—Monongahela Valley Traction Co. contemplates the erection of a $350,000 power plant as an auxiliary to the steam plant; the new plant will be located at Hutchinson; company is controlled by owners of the Consolidated Coal Co.

PARKERSBURG, W. VA. — The Second National Bank will build a bank and office building to cost $50,000; Dennison, Hirons & Derbyshire, architects, New York, have completed plans.

SALEM, W. VA.—Salem Electric Light Co., recently incorporated, contemplates the erection of an electric light plant; J. W. Meredith and H. R. Hall, of this city, and others, are interested; company is capitalized at $25,000.

WHEELING, W. VA.—Pollock Tobacco Co. is planning to erect a ten-story building to extend from Main to Water street.

ATTICA, IND.—Tishomingo Tie & Stone Co., recently organized to manufacture concrete building products, will probably establish a plant in Attica; $15,000 has been already subscribed; Messrs. Edwards, Marshall and Killen are interested in the location of such a plant.

INDIANAPOLIS, IND.—Merchants Heat & Light Co. has increased its capital stock from $1,500,000 to $2,000,000.

MARION, IND.—Aluminum Hollowware Co. has been incorporated; $10,000 capital stock; by Henry E. Newbrough, George D. Soultz, George F. Hruman.

TIPTON, IND.—Fire did about $35,000 damage to the Lake Erie & Western railroad machine shops.

CARPENTERSVILLE, ILL.—Illinois Iron & Bolt Co. was badly damaged by fire.

CHICAGO.—Fire did about $5,000 damage to the plant of E. A. Rysdon & Co., 527 West Forty-first street, manufacturers of sheet metal.

DE KALB, ILL.—Kohler & Die Specialty Co. will start work shortly on its proposed two-story plant.

DETROIT.—Newman Construction Co. has been incorporated; $10,000 capital stock; by Rose Newman, John Newman, Frances Blanchard.

DETROIT.—Gas Lock Specialty Co. has been incorporated; $25,000 capital stock; by Sherwood B. Adrus, C. A. Palmer, John W. Leadley, Charles R. Chisholm.

DETROIT.—Magee Sheet Metal Specialty Co. has been incorporated; $10,000 capital stock; by Wilbur R. and Dessie R. Magee, Frank W. Atkinson.

DETROIT.—Detroit Hardware Specialty Co. has been incorporated; $10,000 capital stock; by Otto Kaiser, Anthony J. Rademacher, Anthony J. Mues, Mary and Albert Ratajozak.

BALDWIN, WIS.—A. B. Miller, West Second street, New Richmond, Wis., has purchased a factory building at Baldwin, Wis., and will equip for the manufacture of dry-cleaning machinery; the Baldwin Cleaning Machine Co., with $10,000 capital, has been organized to carry on the business.

BELOIT, WIS.—The trustees of Beloit College have engaged Patton, Holmes & Flynn, architects, Chicago, to prepare plans for a new brick, steel and concrete physical training building to embody the present gymnasium. Rev. E. D. Eaton is president.

DE PERE, WIS. — Western Steel & Iron Works Co., will build an addition to its plant which will double its present size, immediately west of the works; construction will be undertaken if adequate provision is made for sewers; the company has received a proposition from the citizens' association of Green Bay, to move its business to that city, but no decision has been reached as yet.

GREEN BAY, WIS.—A $60,000 fireproof hospital will be erected by the Wisconsin Deaconess Hospital Association at Green Bay. P. T. Benton, architect, is preparing plans for a three-story building, 45 x 108 feet.

LA CROSSE, WIS. — An $80,000 physical training building will be erected next year at the La Crosse Normal school; plans are being prepared by Parkinson & Dockendorff, architects, La Crosse; bids will be taken by William Kittle, secretary, normal regents, Madison.

LA CROSSE, WIS.—The board of trade is raising funds by means of stock subscriptions to assist the La Crosse Washer Co., manufacturing power and manual washing machines and other private and public laundry equipment in increasing its output.

MADISON, WIS.—The railway commission of Wisconsin has authorized the Minneapolis, St. Paul & Sault Ste. Marie R. R. Co. (Soo Line) to increase its capital stock from $42,000,000 to $63,000,000; the new stock is to be used for building extensions.

MADISON, WIS.—The board of state university regents has awarded the general contract for the erection of the superstructure of the proposed physics building and laboratory to the Wisconsin Construction Co., Chippewa Falls, Wis., at $180,775; there may be a hitch in early signing of the contract because of the retrenchment policy of the state government, but it is expected that work will begin by Feb. 15 at least.

MANITOWOC, WIS.—Articles of incorporation have been filed by Manitowoc Electric Implement Co., $25,000 capital stock; by

George P. Brunner, Frank Brixius and Joseph Brunner.

MANITOWOC, WIS.—Manitowoc Land & Fuel Co. has awarded the general contract for the erection of its coal dock, storage and coal handling plant at Manitowoc to the Worden-Allen Co., Milwaukee; the site is 160 x 200 feet, on Manitowoc river.

MILWAUKEE.—Koban Mfg. Co., 241 South Water street, manufacturing motors, has increased its capital stock from $50,000 to $75,000.

MILWAUKEE.—Leenhouts & Guthrie, architects, are preparing plans for a $75,000 apartment house to be erected next spring on Twelfth street, near Grand avenue, Milwaukee, by Frank C. Courtenay and Charles F. Gilman.

MILWAUKEE. — J. E. Hathaway & Co., manufacturing pile drivers and doing general contracting in this line, has been incorporated as J. E. Hathaway Co. with $50,000 capital; incorporators include W. W. Whitney, E. Hafeman and J. Eppenberger.

MILWAUKEE.—Federal Rubber Mfg. Co., Milwaukee, with works at Cudahy, Milwaukee county, Wis., is planning a tire manufacturing building, of brick and mill construction, 44 x 124 feet, which is part of the $500,000 improvement scheme started during the present year; Byron C. Dowse, president.

NEW RICHMOND, WIS. — The common council has disposed of a bond issue of $12,000 waterworks construction bonds to cover extensions and improvements to the municipal water plant in 1915.

OCONTO, WIS.—J. A. Urquhart is having plans prepared for a hay and grain warehouse and elevator and feed mill, to cost about $20,000.

OSHKOSH, WIS.—A. W. Schram Manufacturing Co., capital stock $100,000, has been incorporated by Thomas Meany, G. H. Young and P. D. Claud.

OSHKOSH, WIS.—Universal Motor Co. has been incorporated to take over the business of Termaat & Monahan, engines and machinery; $25,000 capital stock; by John D. Termaat, Louis. J. Monahan and A. B. Dye.

OSHKOSH, WIS.—Van Ryn & DeGelleke, architects, Milwaukee, Wis., are preparing plans for a $100,000 addition to Oshkosh Normal school, bids to be taken by William Kittle, secretary, Madison, Wis., some time next year. It will be three stories and basement, 44 x 264 feet in size, of brick, steel and concrete; same architectural firm is also engaged in drawing plans for an $80,000 factory building for the normal school at Stevens Point, Wis.

PLYMOUTH, WIS.—C. F. Kade Fixture & Showcase Co., which recently increased its capital stock from $35,000 to $75,000, is making plans to erect two wood and metal working shops, 60 x 180 feet, and two new dry kilns; considerable new wood-working machinery will be required. C. F. Kade is president.

RACINE, WIS. — James Mutter, county highway commissioner, is making plans for a $10,000 steel bridge, on concrete abutments, to be erected in Mount Pleasant, Racine county; bids will be taken about March 15.

RACINE, WIS.—It is expected bids will be called for soon after Jan. 4 for the construction of the proposed Y. M. C. A. building, for which purpose $175,000 has been raised by popular subscription; plans are being completed by C. D. McLane, architect, Rock Island, Ill., assisted by Guilbert & Funston, architects, Racine; the building will be of brick, steel and concrete, six stories and basement, 130 x 175 feet, with gymnasium, swimming pool, lockers and 100 sleeping rooms.

SHEBOYGAN, WIS.—The common council has included in the 1915 budget an appropriation for the establishment of a garbage incinerating plant to cost about $10,000

WAUSAU, WIS. — Farmers' Co-Operative Co., $250,000 capital stock, will begin work on a cold storage, packing, mill and elevator plant at Wausau shortly; foundation to be put in during the winter; Dr. D. Sauerhering, president, and H. E. Schueler, secretary-treasurer.

WEST ALLIS, WIS.—The waterworks improvements contemplated under the $10,000 bond issue sold last week include a new main in Burnham street and standpipe or reservoir; the source of supply is the Milwaukee municipal waterworks.

WEYAUWEGA, WIS.—Weyauwega Milling Co., has been incorporated; $25,000 capital stock; by David E. and Harry B. Reese and Frank S. Bradford.

ST. LOUIS.—Polyplane Motor & Metal Mfg. Co. has been incorporated; $100,000 capital stock; by G. A. Krause, W. P. Morgan, Charles Klein, F. P. Smith, etc.

DULUTH, MINN.—Fire badly damaged the Duluth, Winnipeg & Pacific railroad roundhouse.

SOUTHERN STATES

NORFOLK, VA.—Virginia Life Boat Corporation has received its charter to construct and repair boats, etc., $200,000 to $500,000 capital stock; C. D. Powell, president; C. L. Walker, secretary-treasurer.

RICHMOND, VA.—Tredegar Iron Works is reported to be figuring on a shrapnel contract.

RALEIGH, N. C.—Raleigh Iron Works have secured a permit for a $3,000 addition, containing seven rooms, including an office and additional shop facilities.

ORANGE, TEX.—Commercial club is investigating a proposition for the location of a steel plant in this city.

WESTERN STATES

LARNED, KAS.—City will receive bids until Jan. 8 for two motor-driven pumps, one 125 and one 150 kilowatts, direct-connected units, and electric distributing system; Worley & Black, Kansas City, Mo., engineers.

WICHITA, KAS.—Royer Ensilage Harvester Co. has been incorporated; $100,000 capital stock; by R. W. Clarence, J. H. and Milton Royer, Walter Bamgartner, O. A. Bassett, J. F. Axtell.

HAVRE, MONT. — County commissioners will receive bids until Jan. 5 for $125,000 bonds for the construction of a county courthouse and jail building; F. F. Bossouth is architect.

LIVINGSTON, MONT. — Montana Improved Spring Wheel Co. has plans prepared for a factory in Livingston for the manufacture of spring wheels for automobiles.

LEWISTON, IDA.—Council has granted a franchise for operation of street cars in this city, to Notz Syndicate, Minneapolis; R. C. Dahlkjeim represents the syndicate.

PRESTON, IDA.—Ogden, Logan & Idaho Electric road will extend its line to this place and erect a brick depot at an estimated cost of $200,000; the road will be in operation by March 1.

SODA SPRINGS, IDA.—This place will vote Dec. 28 on $15,000 bonds for construction of a municipal light plant; J. F. Woodall is chairman of the board.

EVERETT, WASH. — County commissioners have granted a franchise to the Jim Creek Water & Power Co., Arlington, Wash., for the erection of an electric wire distributing system on county roads.

RITZVILLE, WASH.—Big Bend Machinery & Supply Co. has been incorporated; $10,000 capital stock; by W. F. York, C. W. Rathbun, P. R. Clark.

SEATTLE. — J. F. Duthie & Co., East Waterway, have been awarded the contract for constructing a stern wheel wooden cannery tender for the Northwestern Fisheries Co., Orca, Southwest, Alaska, at about $32,000; it is to be about 120 feet long, 30-foot beam and 3½-foot draft; it will be equipped with a locomotive marine boiler and a 300-horsepower engine.

SEATTLE.—An American consular officer advises that a company in the far east is considering the installation of a block signal system for a double track railroad complete with telephone system, and it is desired to obtain equipment from America; refer to No. 14,782; another American consular officer in the far east advises that a railroad in his district desires to install a telephone system for a municipality; firms interested are requested to send catalogues and price lists; refer to No. 14,785; further information on both above subjects can be obtained from W. B. Henderson, bureau of foreign and domestic commerce, Alaska building, Seattle.

VANCOUVER, WASH.—An issue of $250,000 interstate bridge bonds has been sold to the Portland Trust & Savings Bank at a premium of $1,950 with interest at six per cent.

WALLA WALLA, WASH.—County commissioners have voted to tear down the old courthouse and Henry Asterman, architect, is getting plans under way for a building to cost about $150,000.

BAKER, ORE.—L. R. Stockman, city engineer, has completed estimates for additional water supply, installation of a new unit for electrical generation and a distributing system throughout the city; J. L. Stannard, Portland, is consulting engineer on the project which is estimated to cost $180,000.

PORTLAND, ORE.—County has sold the remaining $1,000,000 of interstate bridge bonds to Morris Brothers, Inc., Portland & Harris Trust & Savings Bank, Chicago; arrangements will be made at once to call bids for construction of the bridge; Waddell & Harrington, Kansas City, Mo., consulting engineers.

SALEM, ORE.—State board has leased Summer and Albert lakes containing deposits of salt to Jason C. Moore, head of a New York syndicate, who states that approximately $6,000,000 will be spent in equipment and development within the next two years; lease must be passed by the state legislature and no work will be done until this step is taken.

LOS ANGELES.—Plans have been started for the Silent Engine Co.'s proposed factory buildings to be erected at Harbor Industrial City for the manufacture of automobiles; announcements as to size and cost of the buildings have not been made.

OAKLAND, CAL.—E. A. Rawitzer and E. B. Derome will erect a foundry to cost about $1,500 on Fifty-ninth street.

CANADA

NEW WESTMINSTER. — It is announced by Industrial Commissioner Darling the Mackie Mill & Mercantile Co., Gettysburg, Wash., has taken preliminary steps for erecting a 200,000-foot capacity sawmill in New Westminster.

NEW CATALOGS

AIR COMPRESSORS.—Two circulars devoted to air compressors recently have been issued by the Gardner Governor Co., Quincy, Ill. One circular, printed in two colors and containing 16 pages is devoted to vertical, high-speed compressors built by this company and several portable outfits also are shown of which this type of air compressor forms an important part. The other circular, containing 16 pages, is devoted to horizontal single-cylinder air compressors, motor-driven, belt-driven and steam-actuated.

IRON AND STEEL PRICES

Corrected up to Tuesday noon

PIG IRON

(Delivery to April 1.)

Bessemer, valley	$13.75 to 14.00
Bessemer, Pittsburgh	14.70 to 14.95
Basic, Pittsburgh	13.45 to 13.60
Basic, eastern Pa.	13.50
Malleable, Pittsburgh	13.70 to 13.95
Malleable, Chicago	13.00 to 13.50
Malleable, Philadelphia	14.50 to 15.00
Malleable, Buffalo	13.00 to 13.25
No. 1X, Philadelphia	14.50 to 14.75
No. 2 foundry, Pittsburgh	13.70 to 13.95
No. 2 foundry, valley	13.00 to 13.50
No. 2 foundry, Cleveland	13.25
No. 2 foundry, Ironton	12.75
No. 2 foundry, Chicago	13.00 to 13.50
No. 2X foundry, Philadelphia	14.25 to 14.50
No. 2X fdy., (N. J. tidewater)	14.00 to 14.25
No. 2X foundry, Buffalo	13.00 to 13.25
No. 2 plain, Philadelphia	14.00 to 14.25
No. 2 plain, (N. J. tidewater)	13.75 to 14.00
No. 2 plain, Buffalo	12.75 to 13.00
No. 2 southern, Birmingham	9.50 to 9.75
No. 2 southern, Cincinnati	12.65
No. 2 southern, Chicago	13.75 to 14.00
No. 2 southern, Phila. delivery	14.50
No. 2 southern, Cleveland	13.50 to 13.75
No. 2 south'n, New York, docks	14.00 to 14.25
No. 2 southern Boston, docks	14.00 to 14.25
No. 2 south'n, interior New Eng.	15.00 to 16.00
No. 2 southern, St. Louis	14.00 to 14.25
Virginia No. 2X furnace	12.25 to 12.75
Virginia 2X, Philadelphia	15.00 to 15.25
Virginia 2X, Jersey City	15.25 to 15.50
Virginia 2X, Boston points	15.50 to 15.75
Gray forge, (eastern Pa.)	13.50 to 13.75
Gray forge, Pittsburgh	13.45 to 13.70
Gray forge, Birmingham	8.75 to 9.00
Silveries, 8 per cent, Cleveland	17.63
Silveries, 5 per cent Birmingham	12.50
Silveries, 5 per cent, Chicago	16.35
Standard low phos., Phil.	19.00 to 20.00
Lebanon low phos., furnace	16.00 to 16.50
Low phos., Pittsburgh	20.95 to 21.20
Charcoal, Lake Superior, Chgo., Nos. 1 to 4	15.75 to 16 50
Charcoal, Buffalo	15.75 to 16.75
Charcoal, Birmingham	25.00

IRON ORE

(Lower lake ports.)

Old range Bessemer, 55 per cent	$3.75
Mesabi Bessemer, 55 per cent	3.50
Old range, non-Bess., 51½ per cent	3.00
Mesabi non-Bessemer, 51½ per cent	2.85

(Per unit Philadelphia.)

Foreign Bess., 50 to 65 per cent	7c
Foreign non-Bess., 50 to 65 per cent	7c

COKE

(At the ovens.)

Connellsville furnace	$1.60 to 1.75
Connellsville fur. contr.	1.70 to 1.75
Connelleville foundry	2.00 to 2.40
Connellsville fdy., contr.	2.25 to 2.50
Wise county furnace	1.75 to 2.00
Wise county foundry	2.10 to 2.40
Pocahontas furnace	1.75 to 2.00
Poca'ontas foundry	2.00 to 2.25
New River, foundry	2.50 to 3.00
New River, furnace	2.00 to 2.25

FERRO-ALLOYS

Ferro-manganese, Baltimore	$68.00
Ferro-silicon, 50 per cent, Pbgh.	$71.00 to 73.00
Ferro-silicon, 50 per cent, Phila.	71.00 to 73.00
Ferro-sil., 12 to 13 per cent, Pgh.	22.90
Ferro-sil., 11 to 12 per cent, Pgh.	21.90
Ferro-sil., 10 to 11 per cent, Pgh.	20.90
Ferro-sil., 9 to 10 per cent, Pgh.	19.90
Ferro-carbon titanium, carloads, per lb.	8c to 12½c

SEMI-FINISHED STEEL

Open-hearth billets, Phila.	$21.40 to 21.90
Forging billets, Phila.	24.40 to 25.40
Forging billets, Pbgh. (nom.)	24.00 to 24.50

Freight Rates via Panama Canal

Rates on finished materials, including plates, shapes, bars, wire, nails, etc., to Pacific coast points via Panama Canal, per 100 lbs., in carload lots, exclusive of insurance and dockage.

From New York	$0.30
From Pittsburgh	.46
From Youngstown	.48
From Niles	.48
From Wheeling	.46
From Steubenville	.46
From Johnstown	.445
From Coatesville	.39
From Steelton	.40
From Bethlehem	.375
From Cleveland	.49
From Chicago	.60

Wire rods, Pittsburgh	$25.00
Billets, Pbgh. and Ygnst.	18.50 to 19.00
Sheet bars, Pbg. and Ygnst.	19.00 to 19.50

RAILS AND TRACK MATERIAL

Stand. Bess., rails, Pbgh	1.25c
Stand. open-hearth rails, Pbgh.	1.34c
Lgt. rails, 8 lbs., Pbgh. & Chgo.	1.22c
Lgt. rails, 12 lbs., Pbgh. & Chgo.	1.17c
Lgt. rails, 16 to 20 lbs., Pbgh. & Chgo.	1.12c
Lgt. rails, 25 to 45 lbs., Pbgh., and Chgo.	1.07c
Relaying rails, standard, Pbgh. & Chgo.	$23.00 to 24.00
Relaying rails, light, Chicago	21.50 to 22.50
Angle bars, st. sect. Pbgh. base.	1.50c
Angle bars, st. sections, Chgo.	1.50c
Spikes, railroad, Pbgh.	1.35c to 1.40c
Spikes, railroad, Chgo.	1.50c
Track bolts, Pbgh.	1.85c
Track bolts, Chgo.	2.00c

Freight Rates, Pig Iron

Mahoning and Shenango valleys to:—	
Cleveland	$ .95
Newark, N. J.	2.85
New England	2.85
Philadelphia	2.65
Pittsburgh	.95
St. Louis	3.18
Buffalo to:—	
Albany, N. Y.	$1.20
New England (all rail)	2.45
New York and Brooklyn (all rail)	2.45
New York and Brooklyn (by canal)	1.00 to 1.50
Virginia furnaces to:—	
Boston docks (r. and w.)	$3.05
New England (all rail)	3.25
New York docks (r. and w.)	2.88
Birmingham, Ala., to:—	
Cincinnati	$2.90
Chicago	4.00
Cleveland	4.00
Louisville, Ky.	2.65
New York (all rail)	6.15
New York (rail and water)	4.25
Philadelphia (all rail)	5.20
Philadelphia (rail and water)	4.00
Pittsburgh	4.90
Savannah, Ga.	2.75
Chicago to:—	
Des Moines	$2.80
Milwaukee	.50
Moline, Ill.	1.47
Omaha	3.58
St. Louis	1.58
Ironton, O., to:—	
Chicago	$2.54
Cincinnati	1.26
Cleveland	1.62
Detroit	1.81
Indianapolis	1.58

SHAPES, PLATES AND BARS

Structural shapes, Pittsburgh	1.05c to 1.10c
Structural shapes, Chicago	1.19c to 1.29c
Structural shapes, Philadelphia	1.20c to 1.25c
Structural shapes, New York	1.21c to 1.26c
Structural shapes, San Francisco	2.00c to 2.05c
Tank plates, Chicago	1.19c to 1.29c
Tank plates, Pittsburgh	1.05c to 1.10c
Tank plates, Philadelphia	1.20c to 1.25c
Tank plates, New York	1.21c to 1.26c
Bars, soft steel, Pittsburgh	1.05c to 1.10c
Bars, soft steel, Chicago	1.19c to 1.29c
Bars, soft steel, Philadelphia	1.20c to 1.25c
Bars, soft steel, New York	1.26c to 1.31c
Hoops, carloads, Pittsburgh	1.25c
Hoops, less carloads, Pittsburgh	1.30c
Bands, Pittsburgh	1.10c
Shafting, carloads, Pbgh., disc. contract	66 to 67
Shafting, less carl'ds, Pbgh., disc.	63
Bar iron, Chicago	0.95c to 1.00c
Bar iron, Philadelphia	1.12c to 1.19c
Bar iron, New York	1.10c to 1.15c
Bar iron, Cleveland	1.15c
Bar iron, Pittsburgh	1.15c
Hard steel bars, Chicago	1.20c to 1.25c
Smooth finish. mchy. steel, Chi.	1.68c

SHEETS AND TIN PLATE

No. 28, black, Pittsburgh	1.80c
No. 28, black, Chicago	1.99c to 2.09c
No. 28, tin mill, black, Pbgh.	1.85c
No. 28, galvanized, Pbgh.	2.80c
No. 28, galvanized, Chgo.	2.89c to 2.99c
No. 10, blue, annealed, Pbgh.	1.35c
No. 10, blue, annealed, Phila.	1.45c to 1.50c
Tin plate, 100 lb., coke base	$3.15 to 3.20

EXTRAS FOR SHEET OR TIN MILL SPECIFICATIONS

(Per hundred pounds.)

Single pickled, cold roll., and re-an.	30 cents
Hot roll'd, pickl'd and ann., tin mill	25 cents
Full pickl'd, cold rolled and re-ann.	50 cents
Auto sheets	75 cents
Blued stove pipe stock	10 cents
Range steel	30 cents
Re-squaring	10 cents
Roller levelling	10 cents
Patent levelling and re-squaring	35 cents
Oiling sheets	10 cents
Deoxidizing	10 cents
Lime finish	10 cents
Open-hearth stamping steel, free from mill scale	55 cents
Special open-hearth deep stpg. steel free from mill scale	80 cents
Extra deep special auto body stock	$1.25
Ext. for 28 gage ov. 32 to 36-in. wide	10 cents
No reduction for sheets not annealed.	

The above extras apply on both sheet and tin mill specifications, at the same rate.

IRON AND STEEL PIPE

(Pittsbugh.)

	Black Butt-weld.	Galv. Butt-weld.
Steel, ¾ to 3 inches	81	72½
Iron, ¾ to 2½ inches	70	61
	Lap-weld.	
Steel, 2½ to 6 inches	80	71½

BOILER TUBES

Steel, 3½ to 4½ inches	73
Iron, 3½ to 4½ inches	60

WIRE PRODUCTS

Wire nails, jobbers, Pittsburgh	$1.50
Wire nails, retailers, Pittsburgh	1.55
Plain wire, jobbers, Pittsburgh	1.30
Plain wire retailers, Pittsburgh	1.35
Galvanized wire, jobbers, Pbgh.	1.70
Galvanized wire, retailers, Pbgh.	1.75
Polished staples, Pbgh.	1.50
Galvanized staples, Pbgh.	1.90
Barb wire, painted, jobbers, Pbgh.	1.50
Barb wire, painted, retailers, Pbgh.	1.55
Barb wire, galv., retailers, Pbgh.	1.95
Barb wire, galv., jobbers, Pbgh.	1.90

IRON AND STEEL PRICES

Corrected up to Tuesday noon

BOLTS AND NUTS

(Delivered within 20-cent freight radius.)

Carriage bolts, ⅜ x 6 inches, smaller or shorter, rolled threads, 80 and 20; cut threads 80 and 15; larger or longer, 75 to 15.

Machine bolts with hot pressed nuts ⅜ x 4 inches, smaller or shorter, rolled, 80 and 25; cut, 80 and 20; larger or longer, 80.

Gimlet and cone point lag or coach screws, 80 and 25.

Hot pressed square, blank or tapped nuts, $6.30 off list; hot pressed hexagon blank or tapped, $7.20 off.

Cold pressed, c. and t. square, blank or tapped, $6 off; hexagon, blank or tapped, ⅝ inch and larger, $7.20; ⅝-inch and smaller, $7.80.

RIVETS

Structural rivets, Pbgh	1.45c to 1.50c
Structural rivets, Chgo	1.68c
Boiler rivets, Pbgh	1.55c to 1.60c
Boiler rivets, Chgo	1.78c

STEEL SHEET PILING

(Pittsburgh.)

Base sizes	1.55c to 1.60c

COLD ROLLED STRIP STEEL

(Subject to regular extras.)

Base price		0.10 to 0.19
Cut to length		Cabon
Hard.	Soft.	1½ in. and wider.
2.85	3.10	0.100 and thicker.
2.95	3.20	0.050 to 0.099 inc.
3.10	3.35	0.035 to 0.049 inc.
3.35	3.75	0.031 to 0.034 inc.
3.60	4.00	0.025 to 0.030 inc.
3.80	4.20	0.020 to 0.024 inc.
4.70	5.20	0.017 to 0.019 inc.
5.10	5.60	0.015 and 0.016
5.95	6.45	0.013 and 0.014
6.55	7.05	0.012
6.90	7.40	0.011
7.25	7.75	0.010
Coils		
2.75	3.00	0.100 and thicker
2.80	3.05	0.050 to 0.099 inc.
2.95	3.20	0.035 to 0.049 inc.
3.10	3.50	0.031 to 0.034 inc.
3.20	3.60	0.025 to 0.030 inc.
3.30	3.70	0.020 to 0.024 inc.
3.60	4.10	0.017 to 0.019 inc.
4.00	4.50	0.015 and 0.016
4.70	5.20	0.013 and 0.014
5.05	5.55	0.012
5.40	5.90	0.011
5.75	6.25	0.010

CAST IRON PIPE

Three to 20 in., Cleveland	$21.50
Twenty-four to 48-inch, Cleveland	21.00
Four-inch, water, Chicago	26.00
Six to 12 inches, Chicago	21.35 to 22.00
Larger sizes, Chicago	23.50
Six-inch, water, New York	20.00 to 20.50
Four-inch, water, Birmingham	19.50
Six-inch and larger, Birmingham	19.50

Gas pipe, $1 per ton higher than water.

WAREHOUSE PRICES

Steel bars, Chicago	1.65c
Steel bars, Cleveland	1.80c
Steel bars, Cincinnati	1.70c to 1.85c
Steel bars, Philadelphia	1.70c to 1.75c
Steel bars, New York	1.80c
Steel bars, St. Louis	1.70c
Iron bars, Chicago	1.65c
Iron bars, Cleveland	1.75c
Iron bars, St. Louis	1.65c
Iron bars, Cincinnati	1.65c to 1.75c
Iron bars, Philadelphia	1.70c
Iron bars, New York	1.65c to 1.70c
Hoops, Chicago	2.15c
Shapes and plates, Chicago	1.75c
Shapes and plates, Cleveland	1.90c
Shapes and plates, Cincinnati	1.80c to 1.90c
Shapes and plates, St. Louis	1.80c
Shapes and plates, Philadelphia	1.70c to 1.75c
Shapes and plates, New York	1.85c
No. 10 blue ann. sheets, Chgo	1.95c
No. 10 blue ann. sheets, Cleve	2.05c
No. 10 blue ann. sh., St. Louis	2.00c
No. 10 blue ann. sheets, Cinci	1.95c
No. 28 black sheets, Chgo	2.55c
No. 28 black sheets, Cleveland	2.45c
No. 28 black sheets, Cincinnati	2.45c to 2.55c
No. 28 black sheets, St. Louis	2.55c
No. 28 galv. sheets, Chgo	3.55c
No. 28 galv. sheets, Cleveland	3.35c
No. 28 galv. sheets, Cincinnati	3.40c to 3.55c
No. 28 galv. sheets, St. Louis	3.55c

Freight Rates, Coke

Connellsville regions, per 2,000 lbs., to:—	
Baltimore	$1.80
Buffalo	1.85
Chicago	2.50
Cleveland	1.60
Detroit	2.10
East St. Louis	2.80
Joliet	2.50
Louisville	2.50
Milwaukee	2.70
New York	2.85
Philadelphia	2.05
Pittsburgh	.75
Richmond, Va.	2.94
Toledo	1.85
Valley Furnaces	1.20
Cincinnati	2.00

IRON AND STEEL SCRAP

(Net Tons.)

No. 1 railroad wrought, Chgo	$ 8.00 to 8.25
No. 1 railroad wrought, Cleve	9.00 to 9.50
No. 1 railroad wrought, St. L.	**7.50 to 7.75**
No. 1 railroad wrought, Cincin	8.00 to 8.50
No. 2 railroad wrought, Chgo	7.50 to 8.00
No. 2 railroad wrought, St. L.	**7.25 to 7.50**
Arch bars and transoms, Chgo	11.00 to 11.50
Arch bars and transoms, St. L.	**10.50 to 11.00**
Knuckles, coup. & sp'gs, Chgo	8.75 to 9.00
Knuckles, coup. & spr'gs, St. L.	**8.50 to 8.75**
Shafting, Chicago	11.50 to 12.00
Shafting, St. Louis	**10.50 to 11.00**
Steel car axles, Chicago	10.50 to 11.00
Steel car axles, St. Louis	**10.50 to 11.00**
Locomotive tires, Chicago	9.00 to 9.50
Locomotive tires, St. Louis	**8.50 to 9.00**
Cut forge, Chicago	7.50 to 8.00
Pipes and flues, Chicago	6.25 to 6.50
Pipes and flues, Cleveland	6.75 to 7.00

Freight Rates, Finished Material

From Pittsburgh, carloads, per 100 pounds to:—

New York	16 cents
Philadelphia	15 cents
Boston	18 cents
Buffalo	11.6 cents
Baltimore	14½ cents
Cleveland	10.5 cents
Cincinnati	15.8 cents
Chicago	18.9 cents
Minneapolis and St. Paul	32.9 cents
Denver	68.6 cents
St. Louis	23.6 cents
New Orleans	30 cents
Birmingham	45 cents
Pacific coast, (all rail)	80 cents
Pacific coast, via Panama canal	41 cents

Pipes and flues, St. Louis	**5.50 to 5.75**
No. 1 cast, Chicago	9.00 to 9.25
No. 1 cast, Cleveland	9.50 to 10.00
No. 1 cast, Cincinnati	8.50 to 9.00
No. 1 cast, St. Louis	9.00 to 9.25
No. 1 busheling, Chicago	7.00 to 7.50
No. 1 busheling, Cleveland	8.00 to 8.25
No. 1 busheling, Cincinnati	5.75 to 6.25
No. 1 busheling, St. Louis	**7.25 to 7.50**
No. 2 busheling, Chicago	6.00 to 6.25
No. 1 boiler plate, cut, Chgo	5.50 to 5.75
No. 1 boiler plate, cut, Buffalo	9.00 to 9.50
No. 1 boiler plate, cut, St. L.	**5.50 to 5.75**
Boiler punchings, Chicago	8.25 to 8.75
Cast borings, Chicago	4.75 to 5.25
Cast borings, Cleveland	5.50 to 5.75
Cast borings, Cincinnati	4.25 to 4.75
Cast borings, St. Louis	**4.00 to 4.50**
Machine shop turnings, Chicago	5.00 to 5.25
Machine shop turnings, Cleveland	5.00 to 5.25
Machine shop turnings, Cinci	4.25 to 4.75
Machine shop turnings, St. L.	**4.50 to 5.00**
Malleable agl., Chicago	7.50 to 7.75
Malleable agricultural, St. Louis	6.50 to 6.75
Malleable, railroad, Chicago	8.00 to 8.50
Malleable, railroad, Cincinnati	6.50 to 7.00
Malleable, railroad, St. Louis	6.75 to 7.00
Angle bars, iron, Chicago	10.75 to 11.25
Angle bars, iron, St. Louis	**9.50 to 10.00**
Angle bars, steel, Chgo	7.75 to 8.00
Angle bars, steel, St. Louis	**8.50 to 8.75**
Stove plate, Chicago	8.25 to 8.50
Stove plate, Cleveland	7.50
Stove plate, Buffalo	9.00 to 9.75
Stove plate, Cincinnati	6.50 to 7.00
Stove plate, St. Louis	7.00 to 7.25
Bundled sheet, Cincinnati	4.00 to 4.50

(Gross Tons.)

Heavy melting steel, Pbgh	$10.50 to 10.75
Heavy melting steel, Buffalo	10.00 to 10.50
Heavy melting steel, Chicago	8.50 to 9.00
Heavy melting steel, Cleveland	9.00 to 9.50
Heavy melting steel, Cincinnati	9.00 to 9.50
Heavy melting steel, eastern Pa.	9.50 to 10.00
Heavy melting steel, New York	7.50 to 7.75
Heavy melting steel, St. Louis	9.75 to 10.00
Bundled sheet, Buffalo	6.25 to 6.50
Grate bars, Buffalo	9.00 to 9.25
Grate bars, New York	6.50 to 7.00
No. 1 railroad wrought, east. Pa.	11.50 to 11.75
No. 1 railroad wrought, Pbgh	10.00 to 10.50
No. 1 R. R. wght., New York	**9.00 to 9.50**
No. 1 R. R. wrought, Buffalo	10.00 to 10.50
Shafting, New York	11.00 to 11.50
Shafting, eastern Pa.	**13.50 to 14.00**
Wrought pipe, New York	7.25 to 7.50
Wrought pipe, eastern Pa.	9.25 to 9.75
Mch. shop turnings, New York	5.00 to 5.25
Machine shop turnings, Buffalo	5.50 to 6.00
Mch. shop turnings, Pbgh	7.50 to 8.00
Mch. shop turnings, eastern Pa.	7.50 to 8.00
Cast borings, New York	5.00 to 5.25
Cast borings, eastern Pa.	7.50 to 8.00
Cast borings, Buffalo	6.00 to 6.50
Cast borings, Pittsburgh	8.00 to 8.50
Stove plate, (Jersey points)	8.00 to 8.50
Stove plate, Pittsburgh	8.50 to 9.00
Stove plate, eastern Pa.	8.50 to 9.00
Shoveling steel, Chicago	8.00 to 8.50
Shoveling steel, St. Louis	**8.00 to 8.50**
Reroll'g rails, 5 ft. & ov., Pbgh	11.50 to 11.75
Reroll. rails, 5 ft. & ov., Chgo	9.50 to 10.00
Reroll. rails, 5 ft. & ov., Cleve.	11.00 to 11.50
Reroll. rails, 5 ft. & ov., E. Pa.	10.50 to 11.00
Reroll. rails, 5 ft. & ov., St. L.	**9.75 to 10.00**
Steel rails, short, Chicago	9.50 to 9.75
Steel rails, short, Cleveland	11.00 to 11.50
Steel rails, short, St. Louis	**9.25 to 9.50**
Iron rails, Cleveland nom.	11.75 to 12.00
Iron rails, Chgo	11.00 to 11.50
Iron rails, Cininnati	10.25 to 10.75
Iron rails, eastern Pa.	13.50 to 14.00
Iron rails, St. Louis	**10.25 to 10.50**
Iron rails, Pittsburgh	13.00 to 13.50
Frogs, switches, guards, Chgo	8.50 to 9.00
Frogs, switches & g'rds, St. L.	**9.25 to 9.50**
Car wheels, (iron), Pittsburgh	10.50
Car wheels, (steel), Pittsburgh	11.50
Car wheels, Chicago	10.00 to 10.25
Car wheels, eastern Pa.	10.00 to 10.50
Car wheels, Buffalo	10.50 to 11.00
Car wheels, (N. J. points)	9.25 to 9.50
Car wheels, St. Louis	**10.25 to 10.50**
Iron axles, Pittsburgh	17.50 to 18.50
Iron axles, Cincinnati	19.00 to 20.00
Iron axles, eastern Pa.	18.50 to 19.00
Iron axles, Buffalo	19.00 to 19.50
Iron axles, Chicago	**15.50 to 16.00**
Steel car axles, New York	11.00 to 11.50
Steel car axles, Buffalo	12.00 to 12.50
Steel car axles, Cleveland	12.00 to 12.50
Steel car axles, eastern Pa.	**13.00 to 13.50**
No. 1 busheling, Buffalo	8.25 to 8.75
No. 1 busheling, Pittsburgh	8.50 to 9.00
No. 2 busheling, Buffalo	5.75 to 6.25
Low phosphorus steel, Buffalo	14.00 to 14.50
Low phosphorus steel, Pbgh	12.75 to 13.25
Low phos. steel, eastern Pa.	13.50 to 14.00
No. 1 forge, eastern Pa.	7.50 to 8.00
No. 1 cast, eastern Pa.	12.00 to 12.50
No. 1 cast, Pittsburgh	10.75 to 11.00
No. 1 heavy cast (N. J. points)	10.25 to 10.50
Mall. iron, agricul., Cleveland	9.00 to 9.50
Mall iron R. R., Cleveland	9.00 to 9.25
Malleable, railroad, Pittsburgh	9.50 to 10.00
Mall., R. R., Buffalo	9.25 to 9.75
Mall. R. R., east. Pa.	8.00 to 8.50
Bundled sheet, Pittsburgh	8.00 to 8.50
Bundled sheet, Cleveland	7.50

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Hardening Iron and Its Alloys

(*Continued from page* 1226.)

ings is seen to occur at the boundaries of groups of twin crystals of different orientation. This may be observed in Figs. 13, 14 and 15, which were taken from the same area of a steel containing 0.17 per cent carbon; Fig. 13 was taken with vertical light, and Figs. 14 and 15 with oblique light, at slightly different angles. It may be noted here that the whole of the twinning that exists cannot possibly be reproduced in two or three photographs. When specimens of this kind are actually examined under the microscope, it is evident that in some crystals these slip lines frequently separate fine twin lamellae of only slightly different orientation, while in others the slipping which has given rise to these lines does not appear to have seriously modified the orientation of adjacent lamellae. The presence of these lines, however, certainly indicates that some disturbance upon the gliding planes has taken place. We have noticed that as the percentage of carbon increases from 0.0 to about 0.9, the degree of twinning produced very materially increases. This fact is clearly illustrated in the Figs. 10 and 11, as compared with Figs. 13, 14 and 15

Preventing Cupola Explosions

(*Continued from page* 1228.)

eration, however, these precautions are frequently neglected. Their execution is usually left to the cupola tender, and when the blower unexpectedly shuts down, it often happens that instead of remaining to carry out the instructions, he will first leave for the engine room to learn the cause of the disturbance and its probable duration. This short delay in conforming to instructions might give rise to a violent explosion when the blower is started again. In case of turboblowers, which are almost soundless in operation, another difficulty is added. The air valve in the engine room may be temporarily shut without the cupola tender even knowing the blast is off, and when the valve is again opened, will he be aware of what has happened from the detonations in the cupola? The admonition to leave the tuyere doors open when the blast is turned on after a temporary shut-down, is not readily lived up to by the melter who finds it a troublesome job to close the doors against the escaping air.

For these reasons it has proved desirable to find means for taking the necessary precautions independently of the cupola attendants, by aid of a simple automatic valve arrangement. An apparatus designed for this purpose is shown in Figs. 1 and 3. Its lower portion is arranged as a suction or intake valve, while the upper part of the apparatus contains a safety or blow-off valve. The valve casing is fastened to the wind box by studs, as far below the lowest tuyere as possible. A wire sieve is inserted between the wind box and the valve casing to prevent the passage of foreign material. The suction valve is ordinarily held open by a helical spring provided with screw adjustment. The valve body is thus kept floating free of the seat and air has access to the interior of the cupola through numerous holes in the valve cover. The spring is so adjusted that the valve body will be pressed against the seat for a blast pressure equivalent to about 8 inches water column. When the wind is shut off, the valve will open when the pressure has decreased to this point.

The safety valve in the upper part of the apparatus is similar to the suction valve except that the safety valve body is normally pressed against the valve seat by a spring, which is set for the highest working pressure of the cupola. The valve will open when the maximum working pressure is exceeded.

The valve casing should be so located on the wind box

as to cause a strong draft through the suction valve in connection with the cupola stack. The zone of fusion in cupolas provided with this safety apparatus is supplied with air as long as the blast is off. After the blast is turned on a certain time will elapse before the pressure is reached at which the suction valve will close and in the meantime the position of the valve disc will permit the blast and any gas present in the wind box to escape into the open air. When the required pressure is reached the suction valve will close. When the blast is shut off, the drop in pressure will cause the suction valve to open automatically at the pressure for which the valve spring is set, and air is again admitted to the zone of fusion in the cupola. In this way the formation of carbon monoxide is prevented and explosions are avoided.

The safety valve in the top part of the casing serves for additional security in emergencies. In case of slagging the tuyers, a portion of the wind will be released automatically by the valve; where a Roots blower is furnishing the blast, both it and the motor will be protected from undue loads.

The safety apparatus is best located on the cupola opposite the tapping hole, and for the sake of further security, two appliances should be provided for each cupola. Fig. 2 shows the apparatus attached to the wind box. The valve areas are proportioned to the inside diameter of the cupola and the capacity of the blower.

The apparatus was designed by the Aktien-Gesellschaft, R. Ph. Waagner; L. & Q. Biro and A. Kurz, of Vienna.

California Magnesite

Up to the present the United States has been dependent largely upon foreign sources for its supply of magnesite or carbonate of magnesia, the imports in 1913 amounting to 172,591 short tons, as compared with only 9,632 tons produced in this country. It is interesting to note that the major portion of the imports (163,715 short tons) came from Austria-Hungary, and that most of the remainder came from Greece, and was landed for calcining at Hamburg and Rotterdam before being reshipped to this country. The question of the adequacy of the domestic supply to meet our needs therefore assumes much importance. The magnesite from Austria-Hungary has been received chiefly at Philadelphia and is used in the manufacture of refractory brick. The Grecian magnesite enters chiefly at New York and is used for all the purposes enumerated above.

Causes for Importing Magnesite

The dependence of American users of magnesite on the foreign supplies is due for one thing to the location of the American deposits in California, at so great a distance from the eastern markets that the freight rates have been prohibitive. The establishment of water transportation through the Panama canal may be expected to alleviate this difficulty. A second cause is the difference in composition between the magnesites of Austria-Hungary and those of California. The former generally contain 6 to 8 per cent of iron, which appears to be beneficial in the manufacture of refractory brick.

With the cutting off of the Austro-Hungarian and possibly of the Grecian supplies there would seem to be every reason why the California industry should be materially advanced. Fortunately the deposits in that state are numerous, and many of them are fairly large and of high grade. In the opening and development of these mines their nearness to railroad transportation seems to have been of more importance than the character or extent of the deposits. Certain deposits, notably in Santa Clara and San Benito counties, are known to be large in extent and of good character of material, but they lie idle owing to the distance the mineral must be hauled to a railroad, while smaller mines close to railroad stations are being worked.

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Remittance should be made to cover eight (8) words for address if box number is used.

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I desire to retire from active business and offer my completely equipped foundry for sale at a PRICE THAT WILL INTEREST YOU if looking for an actual bargain. Plant is well located with plenty of work and is now in full operation. Recent inventory of plant and stock totaled $20,000; can be bought at practically YOUR OWN TERMS AT CONSIDERABLY LESS than this figure, if taken now. Will deal with principals only. For detailed particulars address Box 270, THE IRON TRADE REVIEW, Cleveland, O.

R. R. Laborers

BEST OF AMERICANS AND FOREIGNers for track and construction work; we get the right kind of help supplied free of charge to employers; your patronage solicited. We are also boarding contractors, one man or a train load laborers and tradesmen for foundry and factory. Write, wire or phone Diamond Railway & Contractors Supply Co., 31 S. Canal St., Chicago, Ill. Phone Franklin 3529.

THE IRON TRADE REVIEW

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"BUFLOKAST"

"BUFLOKAST"

"Buflokast"—the dawn of a new day for the user of iron castings—a name denoting castings of ***maximum service*** quality—a name which we have adopted for your protection as well as ours.

"Buflokast" stands for laboratory controlled foundry methods. With unsurpassed foundry facilities, chemical and physical testing laboratories and a model organization of experienced and scientific metallurgists, we are able to produce on any scale the metals which laboratory research and manufacturing experience have shown to be the best suited for any particular purpose.

"Buflokast"—is the name of a service as well as a product. Our studies and long experience in supplying castings have given us valuable data, not only as to the metal itself, but also as to methods of molding, gating and pouring, kind and condition of sands, shrinkage strains, heat treatment after pouring, temperature at which to remove castings from molds, etc.

"Buflokast" stands for the lowest ultimate cost, the only true standard of economy. In short, it is a name by which the most satisfactory and most economical castings are to be designated and recognized.

"Gun Iron" Castings

Our air furnace iron, commonly called "Gun Iron", is one of the "Buflokast" special quality metals. This iron is exceedingly dense, homogeneous and ductile and has a tensile strength nearly double that of iron melted in a cupola. It is the ideal cast iron to use where high tensile strength and long wearing qualities are desired.

Gray Iron, Semi-Steel, Air Furnace Castings
Any Size—Machined or in the rough.

BUFFALO FOUNDRY and MACHINE Co.

50 Winchester Ave. BUFFALO ..... N.Y.

ITR. SERVICE

Alphabetical list of Advertisers, page 109.
Opportunities, page 106.

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Second Hand Machinery, page 107.

"Where to Buy," page 112.
Engineering Directory, page 134.

Boiler, Ship and Structural Rivets

ON EVERY HEAD

Unbroken After 15 Years' Test.

Hold some Reliable Maker Responsible for the Quality of Rivets You Drive

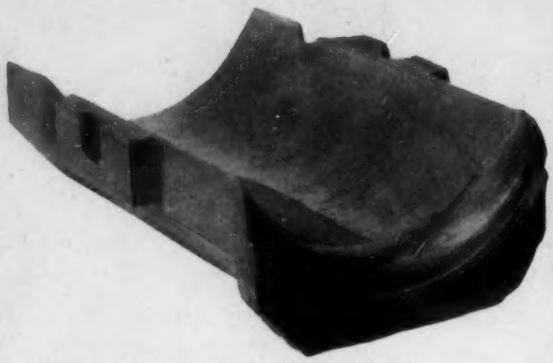
Coupler and Air Brake Pins
STANDARD SPECIFICATIONS

Booklet "Scientific Facts" Free Upon Application.

Largest Rivet Manufacturers in the world—40,000 kegs in stock.

The Champion Rivet Co., CLEVELAND, OHIO, U. S. A.

If Bronze Did Not Heat Would It Not Be Superior to Babbitt Metal?



(Ask us for the record of this bearing)

Amco Frictionless Bronze

does not heat and has proved itself superior to babbitt metal in Armature Bearings, Grinders, Fans and other High Speed Machinery to scores of users.

Let us make you a sample bearing.

If it does not SAVE YOU MONEY
it will COST YOU NOTHING

AMERICAN METAL CO.
(Brass and Bronze Founders)
Park Building PITTSBURGH, PA.

Fig. 51, Type "B" Drive
For General Service

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For general water supply, fire service, and other requirements. Every factory official should have a copy of our Power Pump Catalogue "H".

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Hand and Power Pumps for All Uses

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NOISELESS DURABLE

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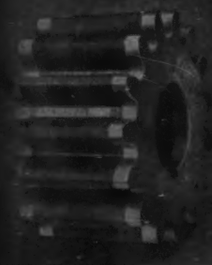

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STEEL CONSTRUCTION

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THE RITER WAY:— A good job conscientiously executed, unrestricted guarantee and the customer's feeling of security.

Municipal and Hydraulic Engineers recognize the superiority of our riveted pipe and penstocks. Let us show you what we have done and can do.

The above is one of our specialties. We design, fabricate and erect plate and structural steel work of every description.
When You Think of Steel Construction, Think of Us.

BLUE CHIP

AND OTHER

FIRTH-STERLING TOOL STEELS

The knowledge, experience and skill of Sheffield combined with the best Pittsburgh practice have made these steels the Standards of Quality and Uniformity wherever Tools are used.

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Corrugated Steel Sheets---Expanded Metal and Metal Lath

Special Sheets for Deep Drawing

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STEEL for Concrete Reinforcement

Engineers - Architects - Contractors

We are prepared to furnish promptly, **Cold Twisted Square Bars**; also **Round, Flat and Plain Square Bars,** for Concrete Reinforcement, in strict accordance with Manufacturers' Standard Specifications.

Our Cold Twisted Square Bars are produced from open hearth steel, structural grade, new billet stock, and have a guaranteed minimum elastic limit of 55,000 lbs. per square inch.

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CORROSION-RESISTING SHEETS

From Architects

Then Give Your VERDICT

A Prominent St. Augustine (Fla.) Architect Writes:

"I have used a good deal of Toncan Metal, and find that it stands the climate of the East Coast of Florida better than anything that I have been able to find. Any metal that will stand the salt air of this region, will stand almost any climate. The cost of this metal should not be considered, as it will last so much longer than any other metal that it is the cheapest in the end."

Here is one from a Prominent Philadelphia Architectural Firm:

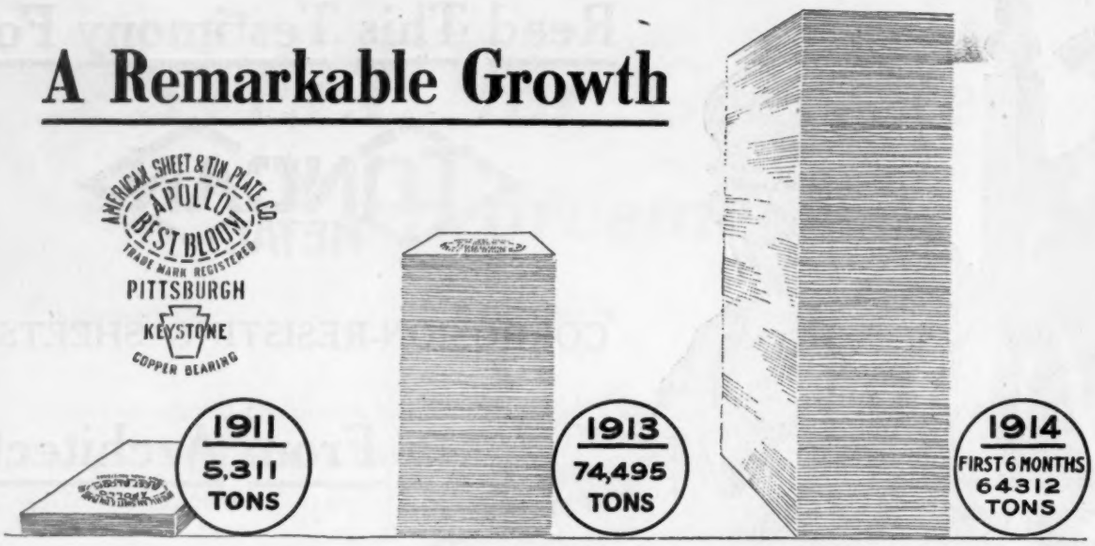
"We consider your Toncan Metal Sheets a very excellent material indeed and quite worth the difference in price over ordinary material. We find that it gives excellent service and in all the cases we have used it, it has proven very satisfactory. It is especially useful and durable when placed where gases are likely to affect metal."

The "Evidence" Book contains more proof. Write for it.

Jobbers Everywhere Sell Toncan Metal.

The Stark Rolling Mill Co., Canton, Ohio

A Remarkable Growth



Proof of the Sheet Metal Workers' endorsement of

Keystone Copper Bearing Sheets

Our booklet "Keystone Copper Bearing Steel—A Discussion on Corrosion" shows an interesting series of actual service tests. We will send you a free copy upon request.

This Company will exhibit at San Francisco 1915 *in the Palace of Mines and Metallurgy*

American Sheet and Tin Plate Company

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Manufacturers of **SHEET AND TIN MILL PRODUCTS** of Every Description

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Y SIDEL BRAND PIPE STAR IRON BRAND

THE YOUNGSTOWN SHEET AND TUBE COMPANY NEW PROCESS PATENTED YOUNGSTOWN, OHIO. GALVANIZED SHEETS

YOUNGSTOWN

Undivided Responsibility

There is no divided responsibility with us. We control every detail of manufacture from the Ore mine to the consumer.

Such complete control of manufacture with the best plant equipment and unified superintendence of iron and steel experts —makes possible year after year this unvariable high standard of quality of **"YOUNGSTOWN"** Pipe.

DOUBLE REFINED PUDDLED IRON ROOFING

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BUCKEYE FENCE

Say you saw it in THE IRON TRADE REVIEW

ANNOUNCEMENT

WE ANNOUNCE THE COMPLETION OF OUR NEW SHEET STEEL PLANT WHICH WILL BE IN OPERATION JANUARY 1st, 1915, FOR THE MANUFACTURE OF THE FOLLOWING PRODUCTS:

BLUE ANNEALED STEEL SHEETS
BOX ANNEALED STEEL SHEETS
PICKLED AND COLD ROLLED STEEL SHEETS
SPECIAL SHEETS FOR DEEP STAMPING
GALVANIZED STEEL SHEETS
STEEL ROOFING AND SIDING
OF ALL DESCRIPTIONS

OUR MOTTO WILL BE QUALITY AND SERVICE.
YOUR PATRONAGE RESPECTFULLY SOLICITED.

THE WESTERN RESERVE STEEL CO.
WARREN, OHIO

WRESCO QUALITY PRODUCTS

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F. J. THOMAS, Mill Manager

Flanged and Dished Boiler Heads.

Saddles, Manholes, Furnace Holes, etc.

WORTH BROS CO.
MANUFACTURERS
COATESVILLE, PA.
U. S. A.

Irregular Heads for Marine Work.

Boiler Tubes Steel Plates and Sheets.

Seneca Iron and Steel Company
STEEL SHEETS

Seneca Brand Stands for Quality

Black, Galvanized, Corrugated and Formed Roofing
Buffalo, N. Y.

LA BELLE

TRADE MARK REGISTERED

There's No Waste to "La Belle" Sheets

There are no flaws in them to be sheared out, no cracks due to bending.

"La Belle" Sheets are soft, ductile, tough.

They yield readily to the skill of the workman, whether in fabricating or stamping into sheet metal specialties.

They are made of uniformly high grade steel, kept so by the fact that we own all our sources of raw materials and control their quality in every process, "from mine to market."

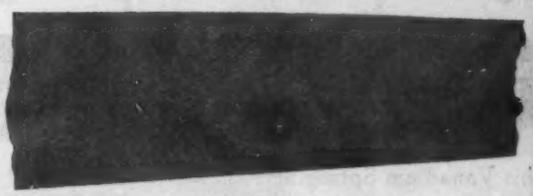
La Belle Iron Works

General Offices:-Steubenville, O.

Works:
Wheeling, W. Va.

Works:
Steubenville, O.

Split Ingot, showing blow-holes



Split Ingot, Typical Armco Iron

The Fight for Durability

Chapter IV

Not many manufacturers know the condition of the inside of an ingot before it is rolled.

Gases that appear in the form of blow holes and a honey-combed condition of the interior of the ingot, play havoc with the durability of the metal, and its fitness for galvanizing or enameling.

Right here we find one of the most serious causes of rapid corrosion of Iron and Steel.

When the ingot is rolled into thin sheets or sections, this honey-combed condition prevails throughout the interior of the sheet, sometimes very near the surface. The pressure of rolling sometimes forces these gases through the thin protecting film. Heat treatment does the same. At times blisters are formed during pickling and galvanizing. What the analysis does not show, the splitting machine makes plain.

ARMCO IRON
Resists Rust

With the equipment to split an ingot we are prepared to guard against honey-combed ingots being rolled into American Ingot Iron.

Very few if any Mills in the country have adopted this progressive step that is the only absolute guarantee of the iron being what it should be.

Pitting, corrosion and blow holes are closely allied. Purity and the elimination of blow holes places Armco-American Ingot Iron in the highest rank of durable products.

The American Rolling Mill Co.

AMERICAN ARMCO INGOT IRON

The trade mark ARMCO carries the assurance that iron bearing that mark is manufactured by The American Rolling Mill Company with the skill, intelligence and fidelity associated with its products, and hence can be depended upon to possess in the highest degree the merit claimed for it.

Licensed Manufacturers under Patents granted to The International Metal Products Company.

Armco-American Ingot Iron Black and Galvanized Sheets, Roofing, Pipe, Gutter, Metal Lath and Terne Plate.

Middletown, Ohio

District Sales Offices at Chicago, Pittsburgh, Detroit, Cleveland, New York, St. Louis and Cincinnati.

FIVE FORCEFUL FACTS ON VANADIUM STEEL

Fact No. 5

Spring Reversed

Fact No. 5

This Vanadium Spring here shown is reversed 27" past a straight line drawn through center of eye.

Our TYPE D CROSS ROLLED VANADIUM SPRING STEEL has Tensile Strength of 180,000 lbs. to 250,000 lbs. with Elastic Limit of 170,000 lbs. to 225,000 lbs. It will carry a load of 80,000 lbs. to the square inch without taking a set.

For service—life—endurance—resistance to fatigue it is superior to anything in the market.

The United Steel Co.
CANTON, OHIO

New York Detroit Chicago

SCULLY SERVICE

"Means Immediate Shipment"

Beams, Channels, Angles and Tees
Plates—Tank, Flange, and Universal
Sheets—Black and Galvanized
"Keystone" Copper Bearing Sheets
Boiler Tubes—
Steel, Charcoal Iron, Seamless
Machinery—Hand and Power
Bars—Mild Steel,
Iron and Sq. Twisted, Norway Iron
Rivets—Cone, Round, and Button Head
Bolts—Machine, Carriage, and
Boiler, Lag Screws, Nuts, Washers,
Dies, Anvils, Nozzles, Valves, etc.
Yale & Towne Hoists, Expanders (Tube)

Scully Steel & Iron Co.
CHICAGO, ILL.
Down Town Office:
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Denver Salt Lake City Los Angeles

CAMBRIA
REINFORCING BARS
TWISTED AND DEFORMED

Structural Shapes
Plain and Fitted

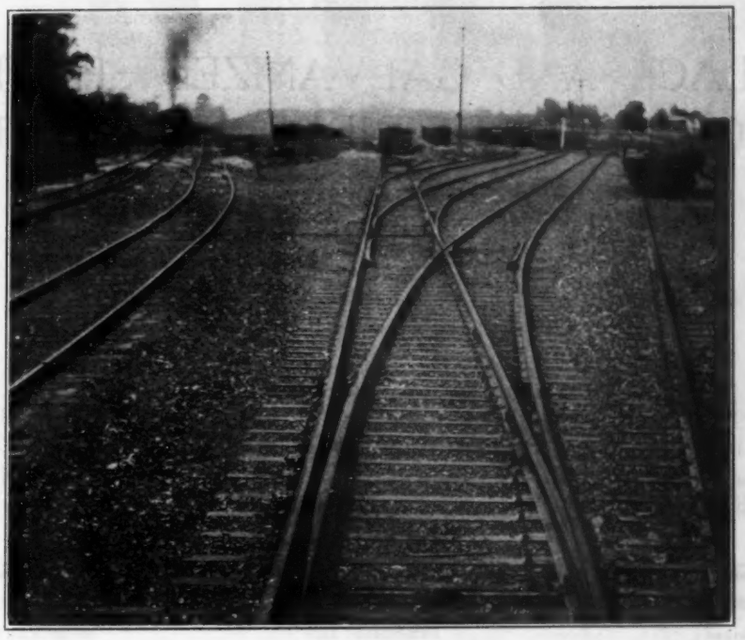
PLATES—UNIVERSAL AND SHEARED

CAMBRIA STEEL COMPANY
PHILADELPHIA
WORKS AT JOHNSTOWN, PA.

District Sales Offices: Atlanta Boston Chicago Cincinnati Cleveland Detroit Los Angeles New York Pittsburg Philadelphia San Francisco St. Louis Tacoma

CARNEGIE STEEL COMPANY

General Offices: PITTSBURGH, PA.



In your "SAFETY FIRST" crusade, do not neglect the safety insured by tracks laid with steel cross ties.

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UNITED STATES STEEL PRODUCTS COMPANY, New York, N. Y. 48-T

The Brier Hill Steel Company

YOUNGSTOWN, OHIO

Manufacturers of

BLACK AND GALVANIZED SHEETS
ROOFING AND KINDRED PRODUCTS

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J. R. Jones, Vice-Pres. and Treas.

Established 1826

W. W. Lukens, Sec. and Asst. Treas.
Howard Wood, Jr., Asst. Sec.

Alan Wood Iron & Steel Co.

PIG IRON BILLETS BLOOMS SLABS
IRON AND STEEL SHEETS AND PLATES
FORGING BILLETS

"A. W. Diamond" and "A. W. Ribbed" Pattern Rolled Steel Floor Plates.

NEW YORK OFFICE:
50 Church St.

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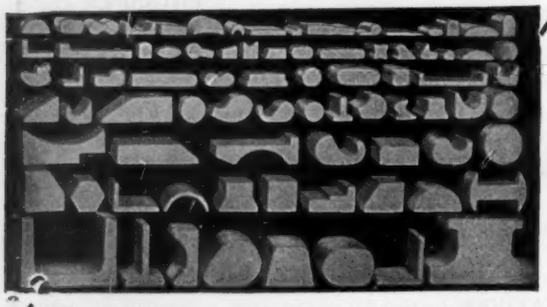

Offices and Warehouses: New York: 460-466 Washington St. Philadelphia: Ninth and Willow Sts. Cincinnati: Spring Grove Avenue. Chicago: Jefferson and Monroe Sts. Boston: 95 Milk Street.

THE WORLD'S LARGEST
Bright Finished Steel Plant
OFFERS YOU
Quality AND Service

Bessemer, Open Hearth, Nickel, Chrome and Vanadium Steel
Service That Is Unequaled
Besides a very large stock carried at the mill,
these Warehouses carry a large and complete stock in all sizes, of
COLD DRAWN SHAFTING and SCREW STOCK
In all sizes of **Rounds, Flats, Squares and Hexagons**

UNION DRAWN STEEL CO., MAIN OFFICE AND WORKS **Beaver Falls, Pa.**

Say you saw it in THE IRON TRADE REVIEW

BESSEMER **STEEL** OPEN HEARTH

BLOOMS, SLABS

SKELP

MERCHANT BARS, SHAPES,
ROUND POLISHED STEEL SHAFTING
BAR IRON, OLD RAIL BARS AND SHAPES

"REPUBLIC" PIPE

Standard, Black and Galvanized
Line Pipe, Drive Pipe, Tubing and Casing

BILLETS

SHEARED PLATES

RAILROAD SPIKES, BOAT SPIKES,
TURNBUCKLES, NUTS, WASHERS,
BOLTS

SHEET and TIN BARS

PIG IRON

Republic Iron & Steel Co.

General Offices, Republic Bldg., Youngstown, Ohio

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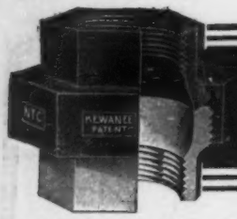
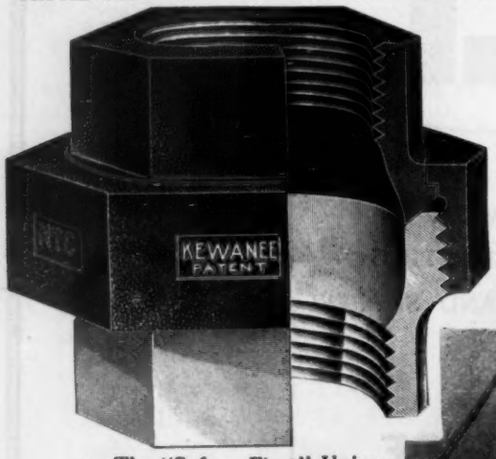


Interesting Experiences

¶ **This is the 20th* of a series which we intend publishing in these pages from time to time, giving actual experiences supplied by consumers of "KEWANEE" Unions.**

The Air-Tested Union with No Inserted Parts



The "Safety First" Union

"KEWANEE" The Air-Tested Union With No Inserted Parts

The Advantages

(1) Brass to iron thread connection—No corrosion.

(2) Brass to iron ball joint seat—No gasket.

(3) 125 pounds compressed air test under water—No defective fittings.

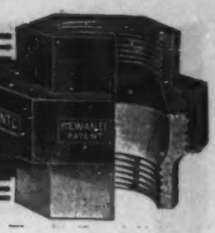
(4) Solid, three-piece construction—No inserted parts.

(5) Easily disconnected—No force required.

The Experiences

**Experience No. 1*—"*Twenty Years' Experience with Unions*," *Published Apr. 9.*
Experience No. 2—"*Will They Stay Tight?*" *Published April 23.*
Experience No. 3—"*I Had Concluded to Stop Trying*," *Published May 7.*
Experience No. 4—"*Johnnie On the Spot*," *Published May 21.*
Experience No. 5—"*'KEWANEES' Never Stick*," *Published June 4.*
Experience No. 6—"*He Cracked His Back*," *Published June 18.*
Experience No. 7—"*Rip 'er Out—Put in 'KEWANEE,'*" *Published July 2.*
Experience No. 8—"*Rot Out Never—If You Use 'KEWANEE,'*" *Published July 16.*
Experience No. 9—"*You Get It All Without a Leak*," *Published July 30.*
Experience No. 10—"*Hundreds of Disconnections—One Union*," *Published Aug. 13.*
Experience No. 11—"*There's An Hour's Difference Between These Joints*," *Pub. Aug. 27.*
Experience No. 12—"*'KEWANEE' Union is Equally Good in Hot and Cold Places*," *Published Sept. 10.*
Experience No. 13—"*Twenty-seven Years*," *Published Sept. 24.*
Experience No. 14—"*This Union Went to Work the Year You Were Born*," *Published Oct. 8.*
Experience No. 15—"*How 'KEWANEE' Eliminates Shut-Downs on Steam Shovel Work*," *Published Oct. 22.*
Experience No. 16—"*'Take-Down' or 'Stick' Unions*," *Published Nov. 5.*
Experience No. 17—"*What is a Mechanic's Time Worth?*" *Published Nov. 19.*
Experience No. 18—"*On a Frosty Morning*," *Published Dec. 3.*
Experience No. 19—"*The Union That Pays for Itself Twice*," *Published Dec. 17.*
Experience No. 20—"*Look Out There!*" *Published Dec. 31.*

with "KEWANEE" Unions



¶ If you have had similar experiences, tell us about them; your brothers in the craft will find yours as interesting as these.

Look Out There! Stop!! Put a "KEWANEE" in There

Experience No. 20

¶ This letter was received from a repair shop foreman of a Florida Railroad†:—

"Gentlemen:—

"Seeing your ad brings to mind an incident with the 'KEWANEE' Union.

"As a fact a mechanic appreciates and has high regard for a money saving and life protecting device. As foreman for the Seaboard Air Line Ry. in this city in June, 1911, I had a mechanic taking off driving wheel tires with a gasoline heater. On going out to see how he was getting along with the job (as you know working with gasoline is somewhat dangerous) I found a union in the pipe connected to the hoop leaking very bad. I knew it was useless to continue to put gaskets in the old union as it was not only expensive but very unsatisfactory, so in a twinkle of an eye I readily saw where a 'KEWANEE' Union would come to my rescue, and give protection to the company and to the operator, as the brass ball joint against the iron will stand high pressure.

"Easy to connect without force, and no corrosion makes it the neatest, safest and most economical union on the market and I think all fair minded men will agree with me.

"With best wishes for 'KEWANEE'S' success, I am,

"Yours truly,

"....."

† Name and address given on request.

¶ This wide-awake fellow saw instantly a danger that a "KEWANEE" Union would eliminate.

¶ "KEWANEE" meant *leakless connection*, in his mind. And he was right.

¶ What about you? Why not find where "KEWANEE" might save YOU time and trouble and possibly disaster? *Write for the Whole "KEWANEE" Family.*

National Tube Company

General Sales Offices - - FRICK BUILDING

DISTRICT SALES OFFICES: Atlanta, Boston, Chicago, Denver, Kansas City, New Orleans, New York, Philadelphia, Pittsburgh, Salt Lake City, St. Louis, St. Paul.

PACIFIC COAST REPRESENTATIVES: U. S. Steel Products Co., San Francisco, Los Angeles, Portland, Seattle.

EXPORT REPRESENTATIVES: U. S. Steel Products Co., New York City.

Panama Pacific Paragraph—No. 13

¶ The Panama Pacific Exposition will present to every Engineer who attends the opportunity to broaden his knowledge of engineering matters. ¶ For instance. As a part of our exhibit will be a motion picture story of the making of the "KEWANEE" Union. ¶ This is only one of thousands of educational features to be presented.

Steel Bars for Concrete Reinforcement

We specialize steel bars for concrete reinforcement.

ROUNDS, SQUARES
and
SQUARE TWISTED
in sizes from ¼" to 1¼"

"Franklin Service"

for years has been recognized throughout the country as being the greatest combination of

Speed, Accuracy, Quality and Price

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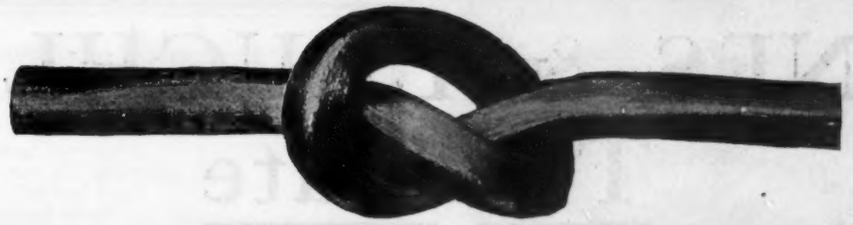

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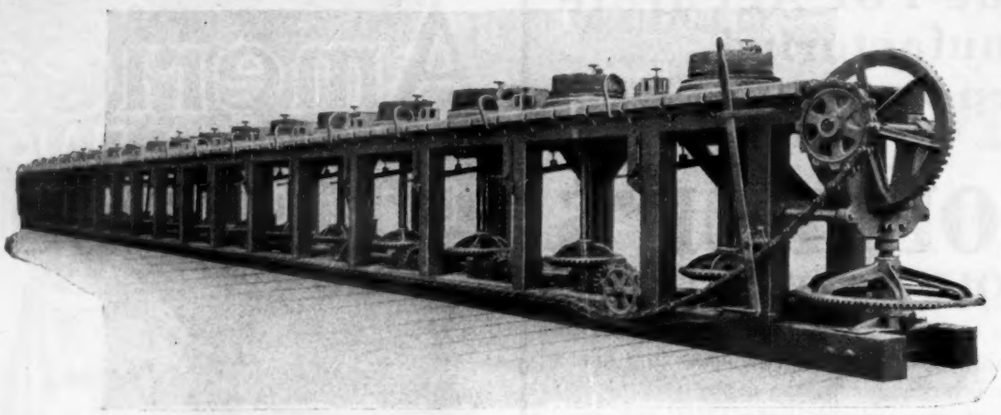

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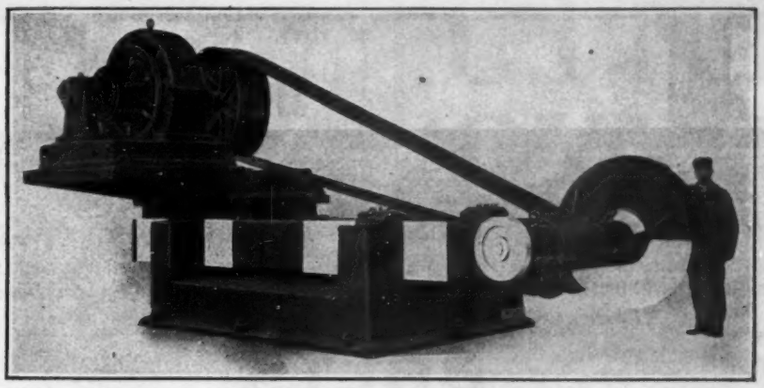

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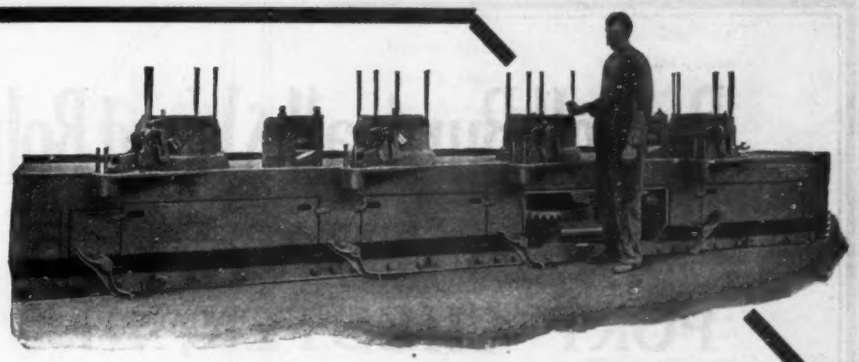
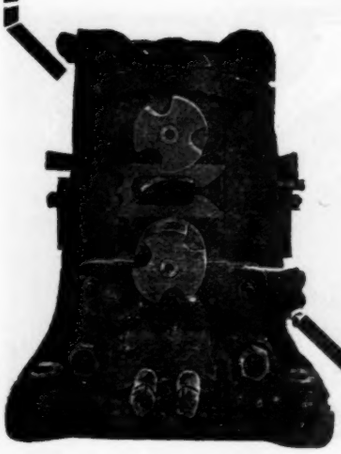


Rod Frame equipped with Carroll Friction Blocks

MILL EQUIPMENT



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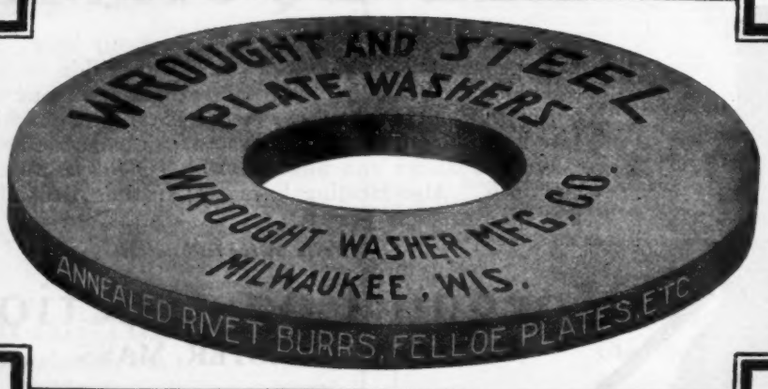
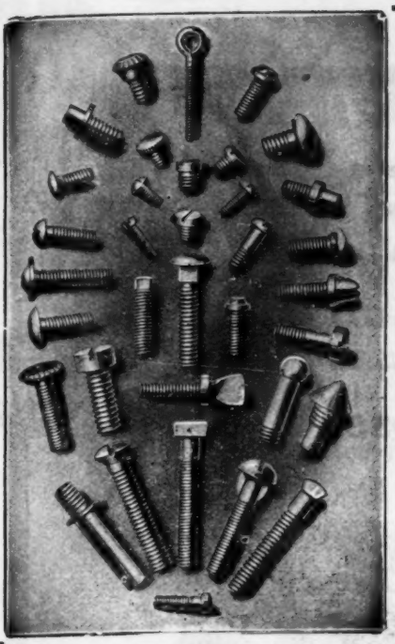


SPECIAL SIZES ON SHORT NOTICE



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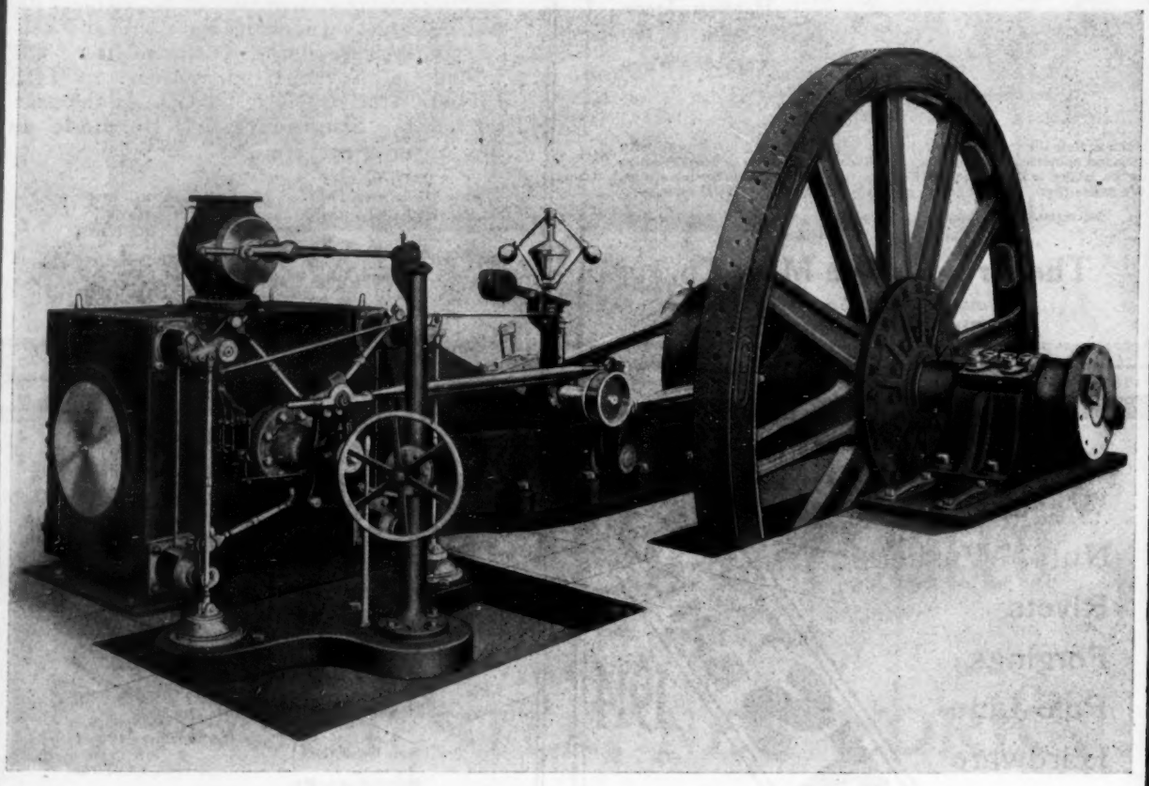

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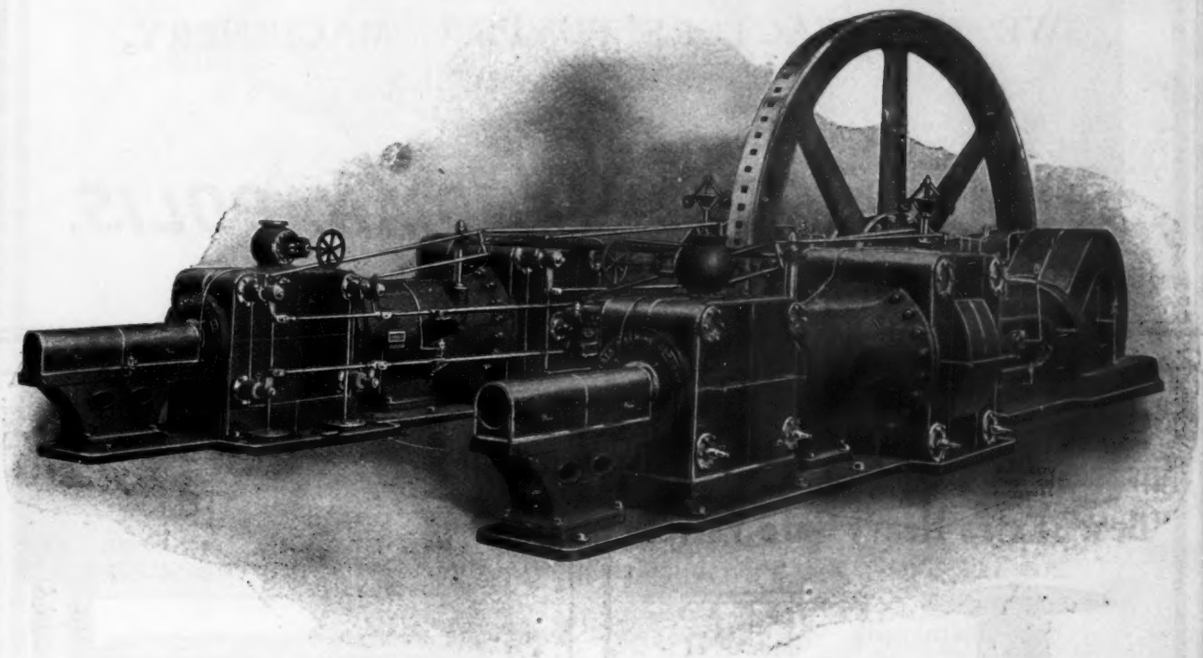

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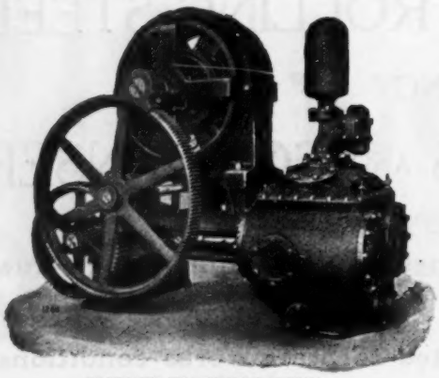

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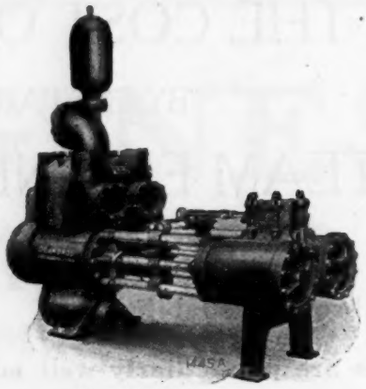

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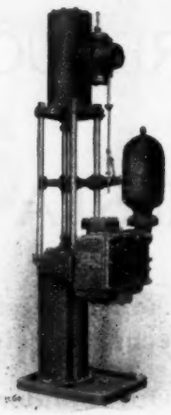

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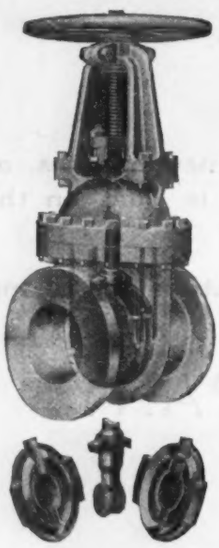

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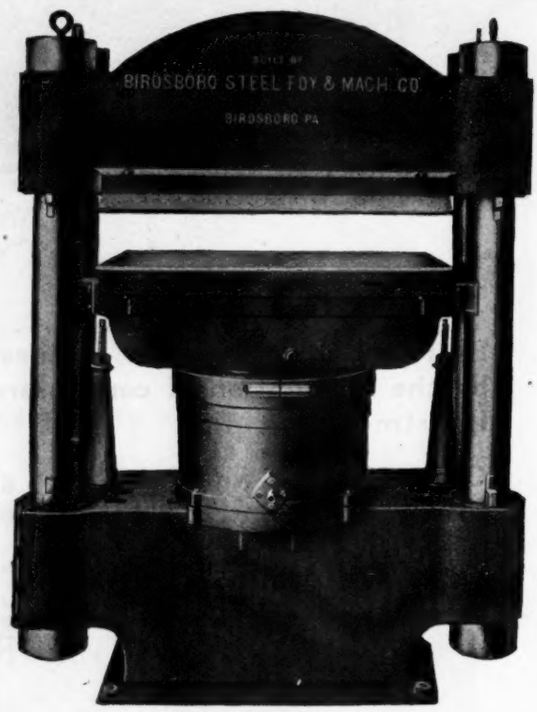

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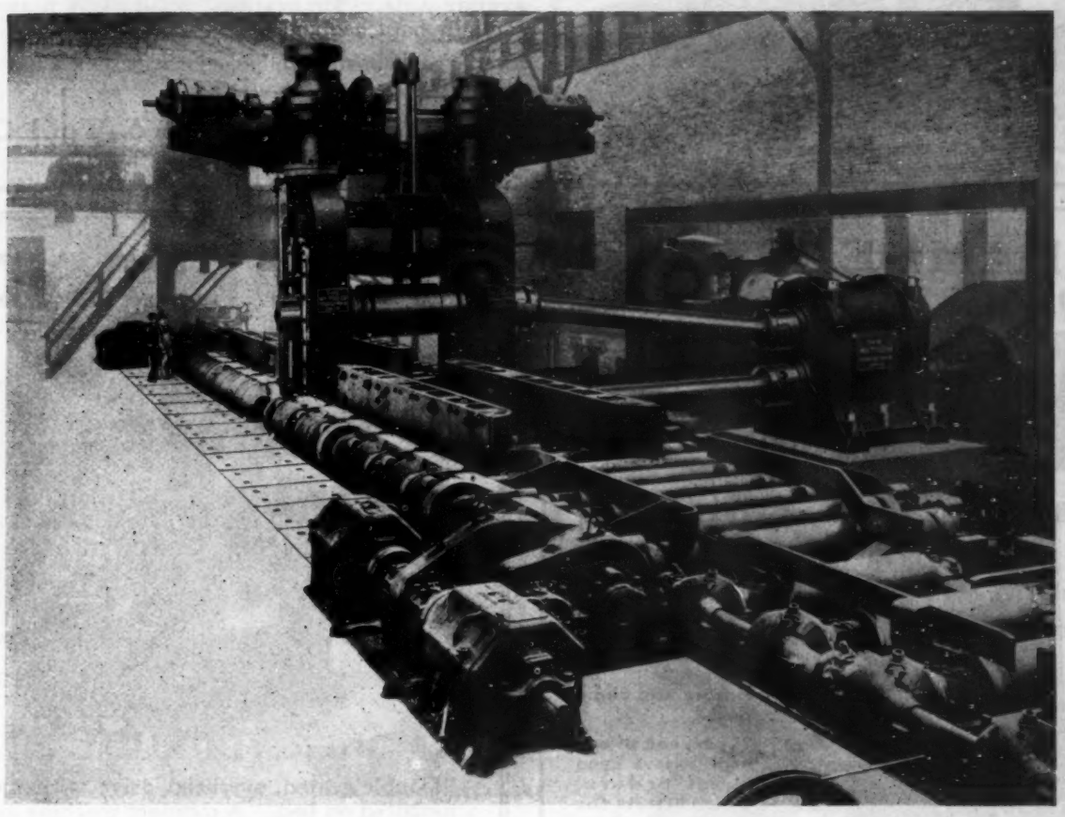

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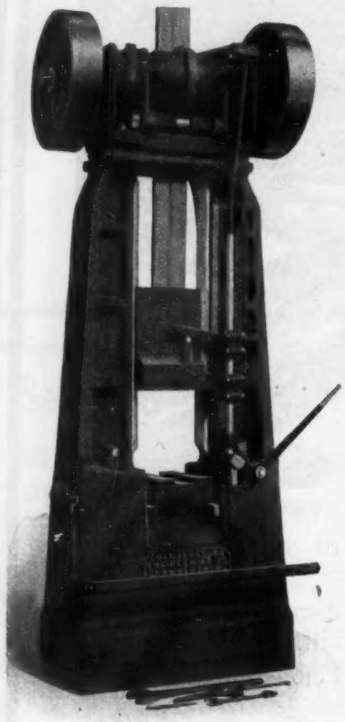

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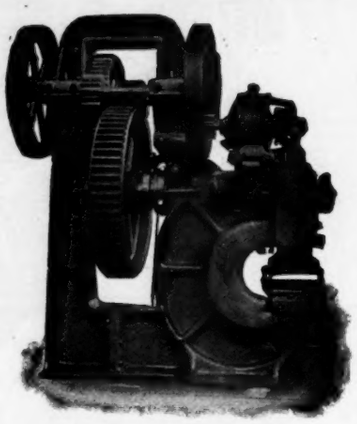

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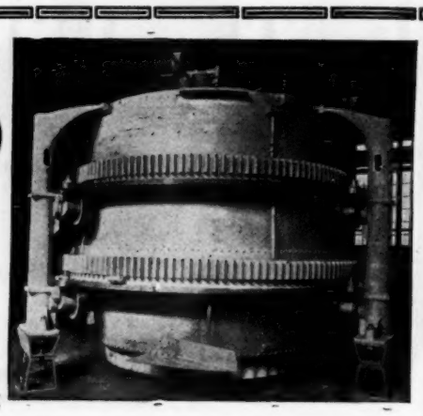

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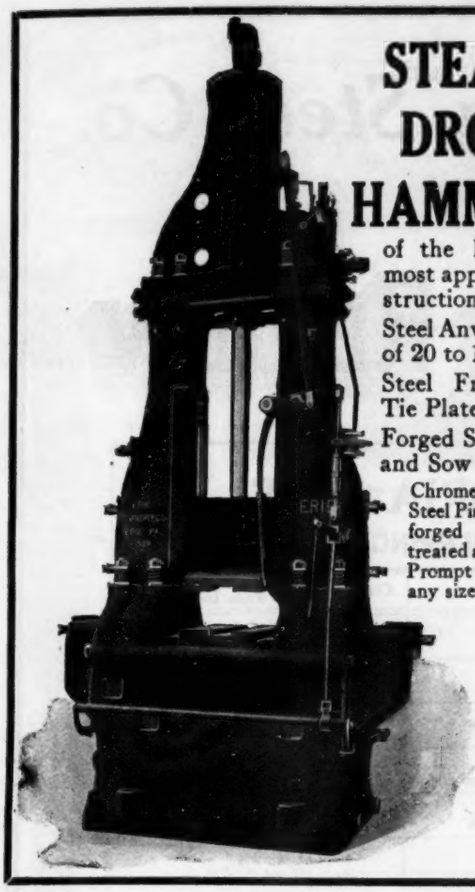

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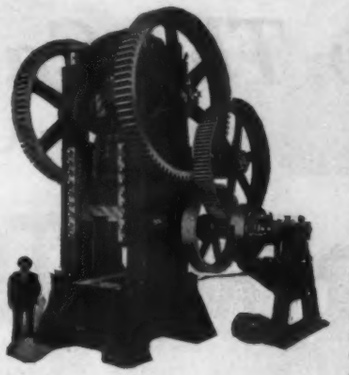

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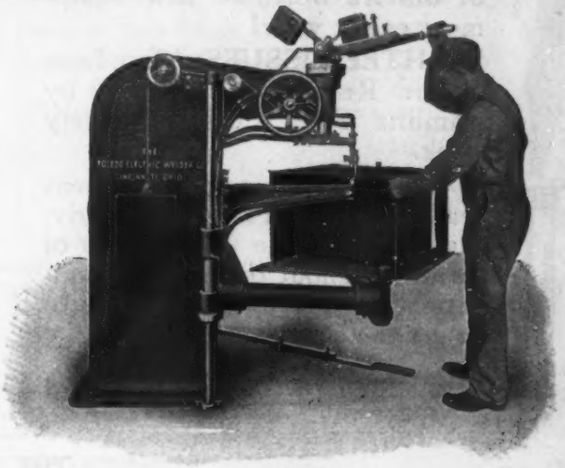

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THE IRON TRADE REVIEW, Cleveland

CLEVELAND, OHIO, DECEMBER 31, 1914

THE IRON TRADE REVIEW

A weekly publication devoted to the Iron, Steel, Machinery and Foundry Industries of the United States and Canada.

Published Every Thursday by THE PENTON PUBLISHING CO., Cleveland.

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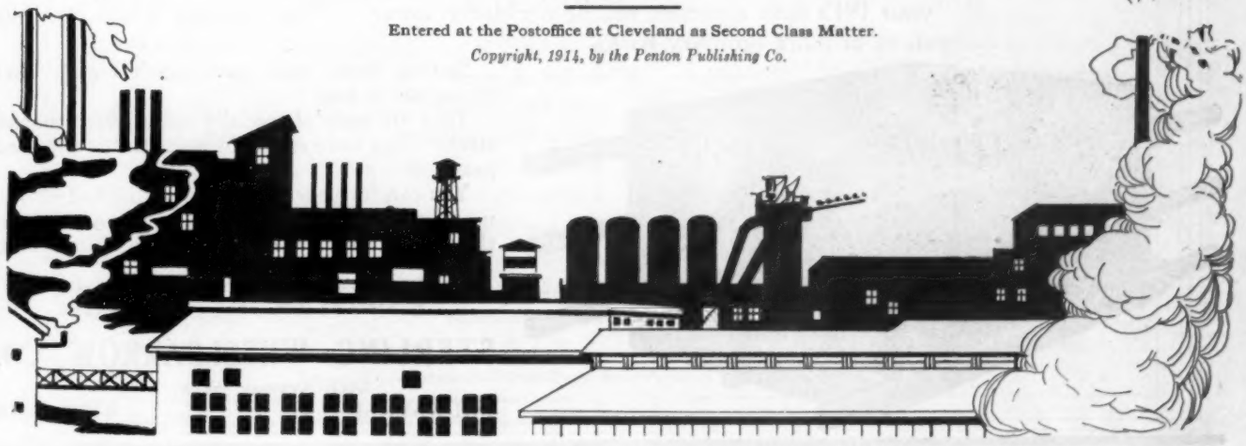

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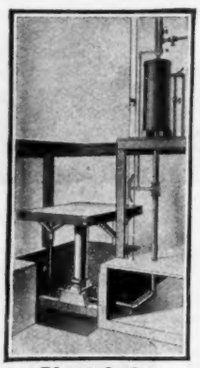

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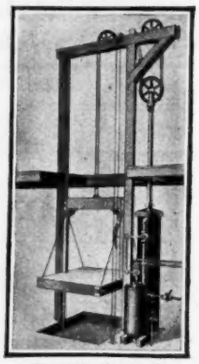

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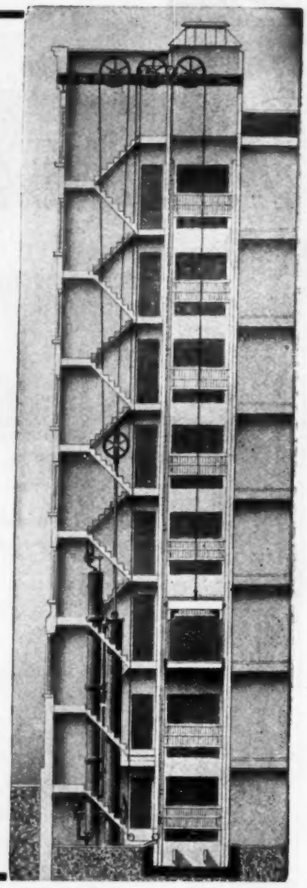

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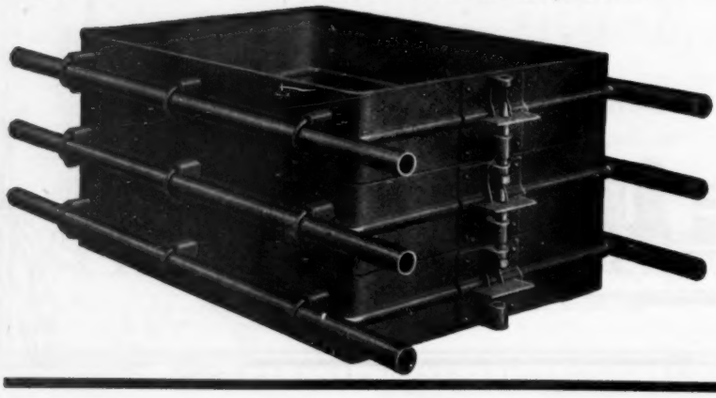

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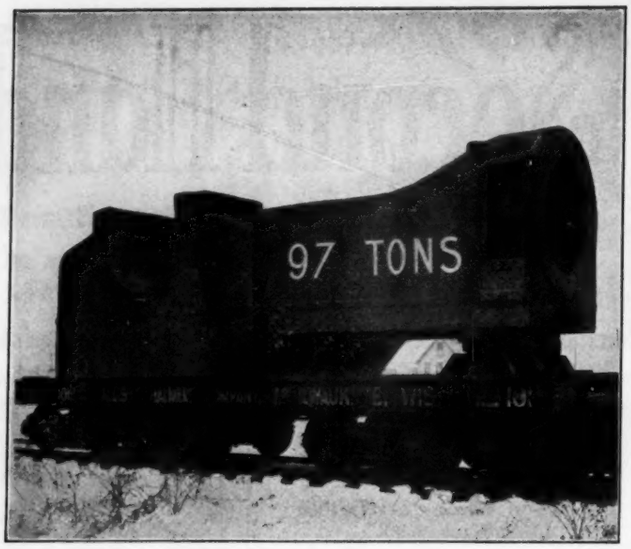

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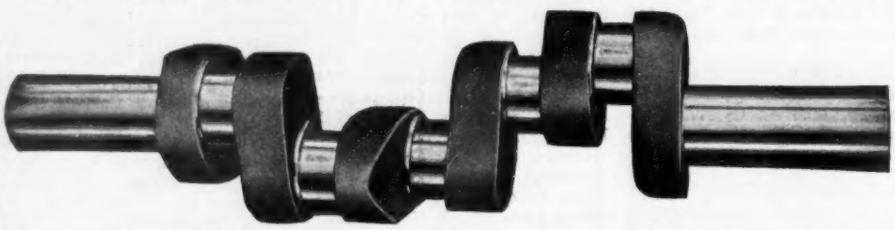

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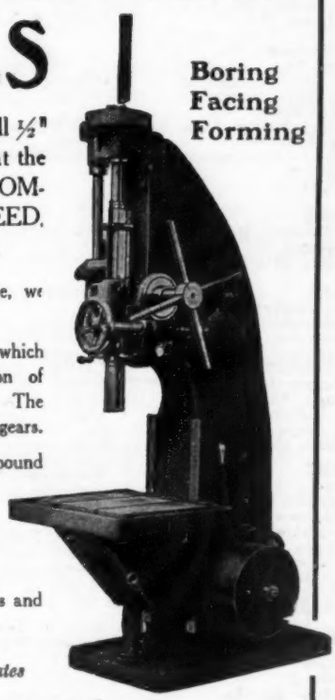

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Hydraulic Press Mfg. Co., Mt. Gilead, O.
Mackintosh, Hemphill & Co., Pittsburgh Pa.
Mesta Machine Co., Pittsburgh, Pa.
Morgan Engineering Co., Alliance, O.
Tod Co., Wm., Youngstown, O.
United Engrg. & Fdy. Co., Pittsburgh, Pa.
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Ryerson, Joseph T., & Son, Chicago, Ill.
Scully Steel & Iron Co., Chicago, Ill.
Tennessee Coal, Iron & R. R. Co., Birmingham, Ala.

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Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

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BARROWS.
(Coal and Coke.)
Sterling Wheelbarrow Co., Milwaukee, Wis.

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Sterling Wheelbarrow Co., Milwaukee, Wis.

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(Pig Iron.)
Sterling Wheelbarrow Co., Milwaukee, Wis.

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Jones & Laughlin Steel Co., Pittsburgh, Pa.
Laclede Steel Co., St. Louis, Mo.
Ryerson & Son, Jos. T., Chicago, Ill.
Upson Nut Co., Cleveland, O.

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(Iron and Steel.)
American Bridge Co., New York, N. Y.
American Iron & Steel Mfg. Co., Lebanon, Pa.
Bourne-Fuller Co., Cleveland, O.
Braeburn Steel Co., Pittsburgh, Pa.
Brown-Wales Co., Boston, Mass.
Carnegie Steel Co., Pittsburgh, Pa.
Cincinnati Iron & Steel Co., Cincinnati, O.
Franklin Steel Works, Franklin, Pa.
Harvey Co., Arthur C., Boston, Mass.
Illinois Steel Co., Chicago, Ill.
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La Belle Iron Works, Steubenville, O.
Lackawanna Steel Co., Buffalo, N. Y.
Laclede Steel Co., St. Louis, Mo.
Lockhart Iron & Steel Co., Pittsburgh, Pa.
McCance Bros. Co., Pittsburgh, Pa.
Milton Mfg. Co., Milton, Pa.
Republic Iron & Steel Co., Youngstown, O.
Ryerson, Joseph T., & Son, Chicago, Ill.
Scully Steel & Iron Co., Chicago, Ill.
Standard Gauge Steel Co., Beaver Falls, Pa.
Tennessee Coal, Iron & R. R. Co., Birmingham, Ala.
United Steel Co., Canton, O.
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Franklin Steel Works, Franklin, Pa.
Illinois Steel Co., Chicago, Ill.
Inland Steel Co., Chicago, Ill.
Lackawanna Steel Co., Buffalo, N. Y.
Laclede Steel Co., St. Louis, Mo.
Upson Nut Co., Cleveland, O.

BARS.
(Sheet.)
Andrews Steel Co., Newport, Ky.
Cambria Steel Co., Johnstown, Pa.
Carnegie Steel Co., Pittsburgh, Pa.
Illinois Steel Co., Chicago, Ill.
La Belle Iron Works, Steubenville, O.
Lackawanna Steel Co., Buffalo, N. Y.
Republic Iron & Steel Co., Youngstown, O.
Tennessee Coal, Iron & R. R. Co., Birmingham, Ala.
Youngstown Iron & Steel Co., Youngstown, O.

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(Splice.)
Carnegie Steel Co., Pittsburgh, Pa.
Lackawanna Steel Co., Buffalo, N. Y.

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(Wrought Iron.)
American Iron & Steel Mfg. Co., Lebanon, Pa.
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BEAD.
(Corner.)
Youngstown Iron & Steel Co., Youngstown, O.

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Franklin Steel Works, Franklin, Pa.
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Jones & Laughlin Steel Co., Pittsburgh, Pa.
La Belle Iron Works, Steubenville, O.
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Otis Steel Co., Cleveland, O.
Portsmouth Steel Co., Portsmouth, O.
Republic Iron & Steel Co., Youngstown, O.
Tennessee Coal, Iron & R. R. Co., Birmingham, Ala.
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BLOCKS.
(Die.)
Carbon Steel Co., Pittsburgh, Pa.

BLOCKS.
(Wood Flooring.)
Ayer & Lord Tie Co., Chicago, Ill.
Jennison-Wright Co., The, Toledo, O.

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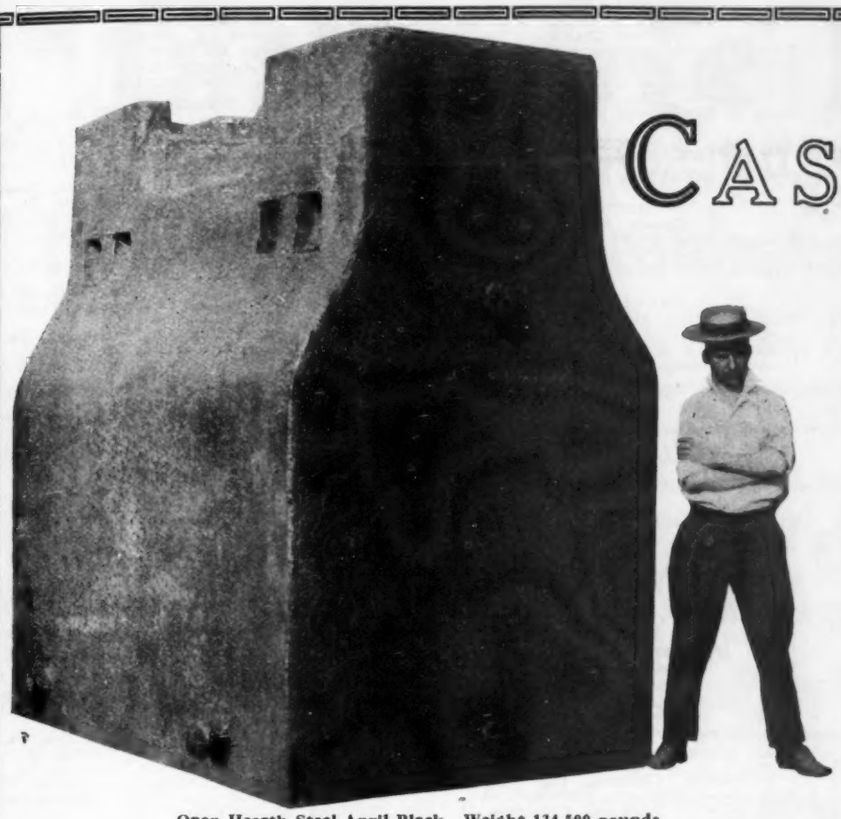

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Inland Steel Co., Chicago, Ill.
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Lackawanna Steel Co., Buffalo, N. Y.
National Tube Co., Pittsburgh, Pa.
Tennessee Coal, Iron & R. R. Co., Birmingham, Ala.
Upson Nut Co., Cleveland, O.
Wood, Alan, Iron & Steel Co., Philadelphia.
Youngstown Sh't & Tube Co., Youngstown, O.

BLOWERS.
General Electric Co., Schenectady, N. Y.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

BOILERS.
New York Central Iron Wks. Co., Hagerstown, Md.
Phoenix Iron Works Co., Meadville, Pa.
Vulcan Iron Works, Wilkesbarre, Pa.

BOLTS.
American Bridge Co., New York City.
American Iron & Steel Mfg. Co., Lebanon, Pa.
Bourne-Fuller Co., Cleveland, O.
Inland Steel Co., Chicago, Ill.
Milton Mfg. Co., Milton, Pa.
Oliver Iron & Steel Co., Pittsburgh, Pa.
Republic Iron & Steel Co., Youngstown, O.
Rockford Bolt Co., Rockford, Ill.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Ryerson, Jos. T., & Son, Chicago, Ill.
Scully Steel & Iron Co., Chicago, Ill.
Upson Nut Co., Cleveland, O.

BOLTS.
(Track.)
American Iron & Steel Mfg. Co., Lebanon, Pa.

BOXES.
(Annealing.)
Mesta Machine Co., Pittsburgh, Pa.
National Mfg. Co., Pittsburgh, Pa.
Swedish Crucible Steel Co., Detroit, Mich.
United Engrg. & Fdy. Co., Pittsburgh, Pa.

BOXES.
(Shop.)
Sterling Wheelbarrow Co., Milwaukee, Wis.

BOXES.
(Sprue.)
Sterling Wheelbarrow Co., Milwaukee, Wis.

BRAKES.
(Electric.)
Electric Controller & Mfg. Co., Cleveland, O.
Toledo Bridge & Crane Co., Toledo, O.

BRAZING.
(Custom.)
Champion Rivet Co., Cleveland, O.
Racine Drop Forge Co., Racine, Wis.

BREAKERS.
(Circuit.)
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

BREAKERS.
(Pig Iron.)
Brown Hoisting Machinery Co., Cleveland, O.

BRICK AND CLAY.
(Fire.)
Blackwell, Geo. G., Sons & Co., Ltd., Liverpool, England.
Brighton Fire Brick Co., New Brighton, Pa.
Brown Construction Co., The P. J., Cleveland.
Clearfield Fire Brick Co., Clearfield, Pa.
Dover Fire Brick Co., Cleveland, O.
Harbison-Walker Refractories Co., Pittsburgh, Pa.
Kier Fire Brick Co., Pittsburgh, Pa.
Louisville Fire Brick Co., Highland Park, Ky.
Ohio Fire Brick Co., Oak Hill, O.
Portsmouth Refractories Co., Portsmouth, O.
Potomac Fire Brick Co., Piedmont, W. Va.
Soisson, Jos., Fire Brick Co., Connellsville, Pa.
Union Mining Co., Mt. Savage, Md.
Valentine & Bros. Co., M. D., Woodbridge, N. J.

BRICK.
(Silica, Magnesia, Chrome.)
American Refractories Co., Chicago, Ill.
Soisson, Jos., Fire Brick Co., Connellsville, Pa.

BRICK.
(Stove Blast Furnace.)
Kier Fire Brick Co., Pittsburgh, Pa.
Union Mining Co., Mt. Savage, Md.

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American Bridge Co., New York, N. Y.

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(Steel.)
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McClintic-Marshall Co., Pittsburgh, Pa.
McMyler Interstate Co., Cleveland, O.
Riter-Conley Mfg. Co., Pittsburgh, Pa.

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(Dynamo.)
Dixon Crucible Co., Jos., Jersey City, N. J.

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Industrial Works, Bay City, Mich.
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Orton & Steinbrenner Co., Chicago, Ill.

BUCKETS.
(Dredge.)
American Bridge Co., New York, N. Y.

BUCKETS.
(Elevator & Hoisting.)
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Illinois Malleable Iron Co., Chicago, Ill.
Wellman-Seaver-Morgan Co., Cleveland, O.

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Hydraulic Press Mfg. Co., Mt. Gilead, O.
Long & Allstatter Co., Hamilton, O.
United Engrg. & Fdy. Co., Pittsburgh Pa.
Watson-Stillman Co., New York, N. Y.

BURRS.
(Rivet.)
Falls Rivet Co., Cuyahoga Falls, O.
Upson Nut Co., Cleveland, O.
Wrought Washer Mfg. Co., Milwaukee, Wis.

BUTTONS.
(Push.)
Electric Controller & Mfg. Co., Cleveland, O.

CABLE.
(Auto Towing.)
American Steel & Wire Co., Chicago, Ill.

CABLEWAYS.
American Steel & Wire Co., Chicago, Ill.
Brown Hoisting Mchy. Co., Cleveland, O.
McClintic-Marshall Const. Co., Pittsburgh, Pa.

CANS.
(Waste, Shop and Oil.)
New Britain Mach. Co., New Britain, Conn.

CARS.
(Annealing, Charging, Pig Iron, Etc.)
Atlas Car & Mfg. Co., Cleveland, O.
Chase Fdy. & Mfg. Co., Columbus, O.
Mesta Machine Co., Pittsburgh, Pa.
Whiting Foundry Equipment Co., Harvey, Ill.

CARS.
(Coal, Coke and Mining.)
American Bridge Co., New York, N. Y.
Atlas Car & Mfg. Co., Cleveland, O.

CARS.
(Electrically Driven.)
Atlas Car & Mfg. Co., Cleveland, O.

CARS.
(Industrial.)
Atlas Car & Mfg. Co., Cleveland, O.
Chase Fdy. & Mfg. Co., Columbus, O.
Whiting Fdy. Equipment Co., Harvey, Ill.

CARS.
(Ingot.)
Youngstown Foundry & Machine Co., The, Youngstown, O.

CASING.
(Oil and Gas.)
National Tube Co., Pittsburgh, Pa.
Youngstown Sheet & Tube Co., Youngstown, O.

CASTINGS.
(Air Furnace.)
Mesta Machine Co., Pittsburgh, Pa.
Tod Co., Wm., Youngstown, O.

CASTINGS.
(Auto.)
Erie Malleable Iron Co., Erie, Pa.
General Malleable Co., Warren, O.

CASTINGS.
(Brass, Bronze and Aluminum.)
American Metal Co., Pittsburgh, Pa.
Arcade Mfg. Co., Freeport, Ill.
Dake Engine Co., Grand Haven, Mich.
Mackintosh, Hemphill & Co., Pittsburgh, Pa.
Tod Co., Wm., Youngstown, O.
United Engrg. & Fdy. Co., Pittsburgh, Pa.

CASTINGS.
(Crucible Steel.)
Adrian Steel Casting Co., Adrian, Mich.
Prime Steel Co., Milwaukee, Wis.
Sivyer Steel Casting Co., Milwaukee, Wis.

CASTINGS.
(Die.)
Atlas Steel Casting Co., Buffalo, N. Y.
Strong Steel Foundry Co., Buffalo, N. Y.

CASTINGS.
(Gear.)
Mesta Machine Co., Pittsburgh, Pa.
Strong Steel Foundry Co., Buffalo, N. Y.

CASTINGS.
(Gray Iron.)
Adamson Machine Co., Akron, O.
American Bridge Co., New York, N. Y.
Arcade Mfg. Co., Freeport, Ill.
Best Mfg. Co., Pittsburgh, Pa.
Birdsboro Steel Fdy. & Mach. Co., Birdsboro, Pa.
Buffalo Fdy & Machine Co., Buffalo, N. Y.
Carroll Foundry & Machine Co., Bucyrus, O.
Dake Engine Co., Grand Haven, Mich.
Erie Foundry Co., Erie, Pa.
Farrell Fdy. & Machine Co., Ansonia, Conn.
Flagg, Stanley G., & Co., Philadelphia, Pa.
Mackintosh, Hemphill & Co., Pittsburgh, Pa.
Marshall Foundry Co., Pittsburgh, Pa.
National Foundry Co., Erie, Pa.
Phoenix Iron Works Co., Meadville, Pa.
Quigley Furnace & Foundry Co., New York, N. Y.
Ross-Meehan Fdy. Co., Chattanooga, Tenn.
Tod Wm., Co., Youngstown, O.
United Engrg. & Fdy. Co., Pittsburgh, Pa.
U. S. Cast Iron Pipe & Fdy. Co., New York, N. Y.
Youngstown Fdy. & Mch. Co., Youngstown, O.

CASTINGS.
(Gray Iron, Car and Locomotive.)
Buffalo Fdy. & Mach. Co., Buffalo, N. Y.
National Foundry Co., Erie, Pa.
Quigley Furnace & Foundry Co., New York, N. Y.
United Engrg. & Fdy. Co., Pittsburgh, Pa.

CASTINGS.
(Gray Iron Machinery.)
Buffalo Fdy. & Mach. Co., Buffalo, N. Y.
Mackintosh, Hemphill & Co., Pittsburgh, Pa.

CASTINGS.
(Malleable.)
Acme Steel & Mall. Iron Works, Buffalo, N. Y.
Belle City Malleable Iron Co., Racine, Wis.
Columbus Malleable Iron Co., Columbus, O.
Erie Malleable Iron Co., Erie, Pa.
Flagg, Stanley G., & Co., Philadelphia, Pa.
General Malleable Co., The, Warren, O.
Illinois Malleable Iron Co., Chicago, Ill.
Lakeside Malleable Castings Co., Racine, Wis.
Marion Malleable Iron Works, Marion, Ind.
Missouri Malleable Iron Co., East St. Louis, Ill.
Moline Malleable Iron Co., St. Charles, Ill.
National Malleable Castings Co., Cleveland, O.
Northwestern Mall. Iron Co., Milwaukee, Wis.
Ross-Meehan Foundry Co., Chattanooga, Tenn.
Standard Malleable Iron Co., Muskegon, Mich.
Wisconsin Malleable Iron Co., Milwaukee, Wis.

CASTINGS.
(Malleable, Car and Locomotive.)
General Malleable Co., The, Warren, O.
Lakeside Malleable Castings Co., Racine, Wis.
Marion Malleable Iron Works, Marion, Ind.
Missouri Malleable Iron Co., East St. Louis, Ill.
National Malleable Castings Co., Cleveland, O.

CASTINGS.
(Manganese Steel.)
Strong Steel Foundry Co., Buffalo, N. Y.
Taylor-Wharton Iron & Steel Co., Highbridge, N. J.

CASTINGS.
(Open-Hearth Steel.)
American Steel Foundries, Chicago, Ill.
Atlas Steel Castings Co., Buffalo, N. Y.
Mesta Machine Co., Pittsburgh, Pa.
National Brake & Elec. Co., Milwaukee, Wis.
Prime Steel Co., Milwaukee, Wis.
Sharon Fdy. Co., Sharon, Pa.
Strong Steel Foundry Co., Buffalo, N. Y.

CASTINGS.
(Semi-Steel.)
Buffalo Fdy. & Mch. Co., Buffalo, N. Y.
Pittsburgh Valve, Fdy. & Const. Co., Pittsburgh, Pa.
Tod Co., Wm., Youngstown, O.
United Engrg. & Fdy. Co., Pittsburgh, Pa.

CASTINGS.
(Steel.)
American Steel Foundries, Chicago, Ill.
Atlas Steel Casting Co., Buffalo, N. Y.
Best Mfg. Co., Pittsburgh, Pa.
Birdsboro Steel Fdy. & Mch. Co., Birdsboro, Pa.
Carroll Foundry & Machine Co., Bucyrus, O.
Farrell-Cheek Steel Fdy. Co., Sandusky, O.
Federal Steel Foundry Co., Chester, Pa.
Mackintosh, Hemphill & Co., Pittsburgh, Pa.
National Foundry Co., Erie, Pa.
National Malleable Castings Co., Cleveland, O.
Otis Steel Co., Cleveland, O.
Pittsburgh Iron & Steel Foundries Co., Pittsburgh, Pa.
Prime Steel Co., Milwaukee, Wis.
Sharon Foundry Co., Sharon, Pa.
Sivyer Steel Casting Co., Milwaukee, Wis.

See Index to Advertisements for pages containing advertisements of companies listed above

Malleable Iron
and Steel Castings
The National Malleable Castings Co.

Cleveland Chicago Indianapolis Toledo
Sharon, Pa. Melrose Park, Ill.

QUALITY SERVICE
The WEST STEEL CASTING Co.
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AUTOMOBILE CASTINGS
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Quality Unsurpassed BUFFALO, N. Y.

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CRUCIBLE & CONVERTOR - STEEL CASTINGS -
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We positively guarantee Quality and Deliveries.
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COLUMBUS, OHIO

National Foundry Co.
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Also Gray Iron Castings
ERIE, PA.

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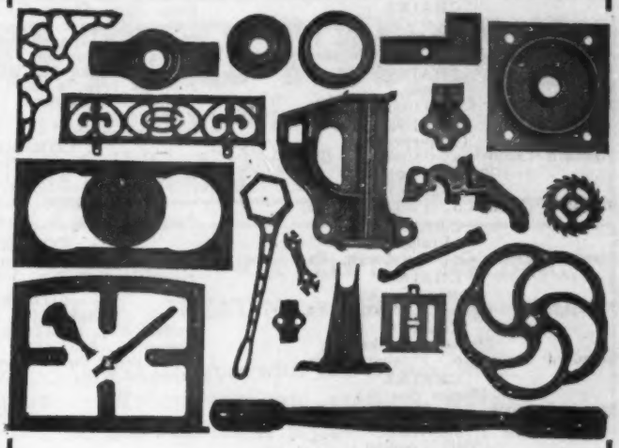
CASTINGS
OF EVERY DESCRIPTION
Annual Capacity 25,000 Tons



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Prices furnished on receipt of Samples or Blue Prints.
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EAST ST. LOUIS, ILL.

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MARION, INDIANA
MALLEABLE CASTINGS
for General Purposes

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Manufacturers of
Acid Open Hearth Steel Castings
of Finest Quality
From 1 Pound to 20,000 Pounds

Also Manufacturers of
Manganese Steel Castings
Small Steel Castings in Large Quantities at Extremely Low Prices
You want the best, send us your drawings for estimate
Office and Works 33 Norris Street Buffalo, New York

CASTINGS.
(Steel.)
(Continued.)
Smith, Geo. H., Steel Casting Co., Milwaukee, Wis.
St. Louis Steel Foundry, St. Louis, Mo.
Strong Steel Foundry Co., Buffalo, N. Y.
Swedish Crucible Steel Co., Detroit, Mich.
United Engineering & Fdy. Co., Pittsburgh, Pa.
West Steel Casting Co., Cleveland, O.
Wheeling Mold & Foundry Co., Pittsburgh, Pa.
Youngstown Fdy. & Mch. Co., Youngstown, O.

CASTINGS.
(Steel, Car and Locomotive.)
American Steel Foundries, Chicago, Ill.
Atlas Steel Casting Co., Buffalo, N. Y.
Carroll Foundry & Machine Co., Bucyrus, O.
National Foundry Co., Erie, Pa.
Otis Steel Co., Cleveland, O.
Strong Steel Foundry Co., Buffalo, N. Y.

CASTINGS.
(Steel Converter.)
Adamson Machine Co., Akron, O.
Sivyer Steel Castings Co., Milwaukee, Wis.
West Steel Casting Co., Cleveland, O.

CASTINGS.
(Steel Electrical.)
National Malleable Castings Co., Cleveland, O.
Smith, Geo. H., Steel Casting Co., Milwaukee, Wis.
Strong Steel Foundry Co., Buffalo, N. Y.
West Steel Casting Co., Cleveland, O.

CASTINGS.
(Steel Machinery.)
American Steel Foundries, Chicago, Ill.
Farrell-Cheek Steel Fdy. Co., Sandusky, O.
Mesta Machine Co., Pittsburgh, Pa.
Strong Steel Foundry Co., Buffalo, N. Y.

CASTINGS.
(Vanadium).
Mesta Machine Co., Pittsburgh, Pa.
Strong Steel Foundry Co., Buffalo, N. Y.

CHAINS.
Jones & Laughlin Steel Co., Pittsburgh, Pa.
Standard Chain Co., Pittsburgh, Pa.
Weimer Chain & Iron Co., Lebanon, Pa.

CHAINS.
(Coil).
Standard Chain Co., Pittsburgh, Pa.

CHAINS.
(Conveyor.)
Standard Chain Co., Pittsburgh, Pa.

CHAINS.
(Crane.)
Standard Chain Co., Pittsburgh, Pa.

CHAINS.
(Dredge.)
Standard Chain Co., Pittsburgh, Pa.

CHAINS.
(Passing Link.)
Standard Chain Co., Pittsburgh, Pa.

CHAINS.
(Railroad Brake.)
Standard Chain Co., Pittsburgh, Pa.

CHAINS.
(Steam Shovel.)
Standard Chain Co., Pittsburgh, Pa.

CHAINS.
(Steel Loading.)
Standard Chain Co., Pittsburgh, Pa.

CHAINS.
(Steel Link.)
Standard Chain Co., Pittsburgh, Pa.

CHAPLETS.
Champion Mch. & Forging Co., Cleveland, O.
Cheney & Son, S., Manlius, N. Y.

CHARCOAL.
Hillman, J. H., & Sons Co., Pittsburgh, Pa.

CHEMICALS.
General Chemical Co., Cleveland, O.

CHEMISTS.
Steel Improvement Co., Cleveland, O.

CHIMNEYS.
Riter-Conley Mfg. Co., Pittsburgh, Pa.

CLAMPS.
National Tube Co., Pittsburgh, Pa.

CLAY.
(Fire Ground.)
Union Mining Co., Mt. Savage, Md.

CLAY DUST.
(Fire.)
Potomac Fire Brick Co., Piedmont, W. Va.

CLEVISES.
American Bridge Co., New York, N. Y.

COAL.
Baird & West, Detroit, Mich.
Brier Hill Steel Co., The, Youngstown, O.
Columbus Iron & Steel Co., Columbus, O.
Eaton, Rhodes & Co., Cincinnati, O.
Hanna, M. A., & Co., Cleveland, O.
Hillman, J. H., & Sons Co., Pittsburgh, Pa.
La Belle Iron Works, Steubenville, O.
Pickands, Brown & Co., Chicago, Ill.
Rainey, W. J., New York, N. Y.
Rogers, Brown & Co., Chicago, Ill.
Semet-Solvay Co., Syracuse, N. Y.
Tenn. Coal, Iron & R. R. Co., Birmingham, Ala.
Washington Coal & Coke Co., Dawson, Pa.

COAL CRUSHERS.
Orton & Steinbrenner Co., Chicago, Ill.

COAL TIPPLES.
American Bridge Co., New York, N. Y.
Eichleay, John Jr., Co., Pittsburgh, Pa.

COCKS, PLUG.
(Acid-Proof.)
National Tube Co., Pittsburgh, Pa.

COCKS.
(Tuyere.)
Best Mfg. Co., Pittsburgh, Pa.

COILS.
(Pipe.)
National Tube Co., Pittsburgh, Pa.

COKE.
Baird & West, Detroit, Mich.
Bourne-Fuller Co., Cleveland, O.
Brier Hill Steel Co., The, Youngstown, O.
Eaton Rhodes & Co., Cincinnati, O.
Hanna, M. A., & Co., Cleveland, O.
Hillman, J. H., & Sons Co., Pittsburgh, Pa.
La Belle Iron Works, Steubenville, O.
McKeefrey & Co., Leetonia, O.
Mohr, J. J., & Son, Philadelphia, Pa.
Pickands, Brown & Co., Chicago, Ill.
Rainey, W. J., New York, N. Y.
Rogers, Brown & Co., Cincinnati, O.
Samuel Frank, Philadelphia, Pa.
Semet-Solvay Co., Syracuse, N. Y.
Snyder & Co., W. P., Pittsburgh, Pa.
Stewart Iron Co., Ltd., Cleveland, O.
Tenn. Coal, Iron & R. R. Co., Birmingham, Ala.
Washington Coal & Coke Co., Dawson, Pa.

COMMERCIAL GRINDING.
Norton Grinding Co., Worcester, Mass.

COMPRESSORS.
(Air.)
Dean Bros. Steam Pump Wks., Indianapolis.
General Electric Co., Schenectady, N. Y.
Mackintosh, Hemphill & Co., Pittsburgh, Pa.
Mesta Machine Co., Pittsburgh, Pa.
National Brake & Elec. Co., Milwaukee, Wis.
Norwalk Iron Works Co., So. Norwalk, Conn.
Tilghman-Brooksbank Sand Blast Co., Philadelphia, Pa.

COMPRESSORS.
(Gas.)
Norwalk Iron Works Co., So. Norwalk, Conn.

CONCRETE REINFORCEMENT.
American Steel & Wire Co., Chicago, Ill.

CONDENSERS.
(Barometric.)
Mesta Machine Co., Pittsburgh, Pa.

CONDENSERS.
(Steam, Jet and Surface.)
Buffalo Fdy. & Machine Co., Buffalo, N. Y.
Cooper, C. & G., Co., Mt. Vernon, O.
Dean Bros. Steam Pump Wks., Indianapolis.
Struthers-Wells Co., Warren, O.

CONDUIT.
(Electric.)
Mark Mfg. Co., Evanston, Ill.

CONSTRUCTION.
(Concrete.)
Kratzer, W. N., & Co., Pittsburgh, Pa.

CONSTRUCTION.
(Steel and Iron.)
Bellefontaine Bridge & Steel Co., Bellefontaine, O.
Eichleay, John Jr., Co., Pittsburgh, Pa.
Kratzer, W. N., & Co., Pittsburgh, Pa.
Riter-Conley Mfg. Co., Pittsburgh Pa.

CONSTRUCTION.
(Steel Plate.)
Acme Boiler Works, Canal Dover, O.

CONTRACTORS.
(Piping).
Best Mfg. Co., Pittsburgh, Pa.
Pittsburgh Piping & Equipment Co., Pittsburgh, Pa.
Pittsburgh Valve, Fdy. & Const. Co., Pittsburgh, Pa.

CONTROLLERS.
(Electric.)
Toledo Bridge & Crane Co., Toledo, O.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

CONTROLLERS.
(Manual, Automatic, Machine Tool, Crane.)
Electric Controller & Mfg. Co., Cleveland, O.

CONVERTERS.
(Steel Casting.)
Tropenas Converter Co., New York City.
Whiting Foundry Equipment Co., Harvey, Ill.

CONVEYORS.
McMyler Interstate Co., Cleveland, O.

COUPLINGS.
Jones & Laughlin Steel Co., Pittsburgh, Pa.
Mark Mfg. Co., Evanston, Ill.
National Tube Co., Pittsburgh, Pa.

CRANES.
(Charging.)
Alliance Machine Co., Alliance, O.
Morgan Engineering Co., Alliance, O.
Niles-Bement-Pond Co., New York, N. Y.

CRANES.
(Electric Traveling.)
Alliance Machine Co., Alliance, O.
Brown Hoisting Machinery Co., Cleveland, O.
Browning Co., The, Cleveland, O.
Euclid Crane & Hoist Co., Euclid, O.
McMyler Interstate Co., Cleveland, O.
Morgan Engineering Co., Alliance O.
Niles-Bement-Pond Co., New York, N. Y.
Northern Enginering Works, Detroit, Mich.
Pawling & Harnischfeger Co., Milwaukee, Wis.
Ridgway & Son, Craig, Coatesville, Pa.
Shaw Electric Crane Co., New York, N. Y.
Toledo Bridge & Crane Co., Toledo, O.
Whiting Foundry Equipment Co., Harvey, Ill.

CRANES.
(Gantry.)
Alliance Machine Co., Alliance, O.
Brown Hoisting Machinery Co., Cleveland, O.
Industrial Works, Bay City, Mich.
McMyler Interstate Co., Cleveland, O.
Morgan Engineering Co., Alliance, O.
Niles-Bement-Pond Co., New York, N. Y.
Northern Engineering Works, Detroit, Mich.
Toledo Bridge & Crane Co., Toledo, O.
Whiting Foundry Equipment Co., Harvey, Ill.

CRANES.
(Grab Bucket.)
Alliance Machine Co., Alliance, O.
Brown Hoisting Machinery Co., Cleveland, O.
Industrial Works, Bay City, Mich.
Niles-Bement-Pond Co., New York, N. Y.
Northern Engineering Works, Detroit, Mich.
Toledo Bridge & Crane Co., Toledo, O.
Whiting Foundry Equipment Co., Harvey, Ill.

CRANES.
(Hand Traveling.)
Euclid Crane & Hoist Co., Euclid, O.
Niles-Bement-Pond Co., New York, N. Y.
Northern Engineering Works, Detroit, Mich.
Toledo Bridge & Crane Co., Toledo, O.
Whiting Foundry Equipment Co., Harvey, Ill.

CRANES.
(Hand Trolley.)
Brown Hoisting Machinery Co., Cleveland, O.

CRANES.
(Hydraulic.)
Alliance Machine Co., Alliance, O.
Chambersburg Engrg. Co., Chambersburg, Pa.
Morgan Engineering Co., Alliance, O.

CRANES.
(Ingot Stripper.)
Alliance Machine Co., Alliance, O.
Morgan Engineering Co., Alliance, O.
Niles-Bement-Pond Co., New York, N. Y.

CRANES.
(Jib.)
Alliance Machine Co., Alliance, O.
Brown Hoisting Machinery Co., Cleveland, O.
Industrial Works, Bay City, Mich.
McMyler Interstate Co., Cleveland, O.
Morgan Engineering Co., Alliance, O.
Niles-Bement-Pond Co., New York, N. Y.
Northern Engineering Works, Detroit, Mich.
Ridgway & Son, Craig, Coatesville, Pa.
Shaw Electric Crane Co., New York, N. Y.
United Engrg. & Fdy. Co., Pittsburgh, Pa.
Whiting Foundry Equipment Co., Harvey, Ill.

CRANES.
(Locomotive.)
Brown Hoisting Machinery Co., Cleveland, O.
Browning Co., The, Cleveland, O.
Industrial Works, Bay City, Mich.
McMyler Interstate Co., Cleveland, O.
Morgan Engineering Co., Alliance, O.
Northern Engineering Works, Detroit, Mich.
Orton & Steinbrenner Co., Chicago, Ill.
Wellman-Seaver-Morgan Co., Cleveland, O.

CRANES.
(Pneumatic.)
Detroit Hoist & Machinery Co., Detroit, Mich.
Northern Engineering Works, Detroit, Mich.
Whiting Foundry Equipment Co., Harvey, Ill.

CRANES.
(Special.)
Alliance Machine Co., Alliance, O.
Brown Hoisting Machinery Co., Cleveland, O.
Euclid Crane & Hoist Co., Euclid, O.
Industrial Works, Bay City, Mich.
McMyler Interstate Co., Cleveland, O.
Morgan Engineering Co., Alliance, O.
Northern Engineering Works, Detroit, Mich.
Shaw Electric Crane Co., New York, N. Y.
United Engrg. & Fdy. Co., Pittsburgh, Pa.

CRANES.
(Steam and Pneumatic, Wire Mills.)
Morgan Construction Co., Worcester, Mass.
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

See Index to Advertisements for pages containing advertisements of companies listed above

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Special and Automobile Drop Forgings furnished from all kinds of steel. We lead in quality and deliver as promised.

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weighing from
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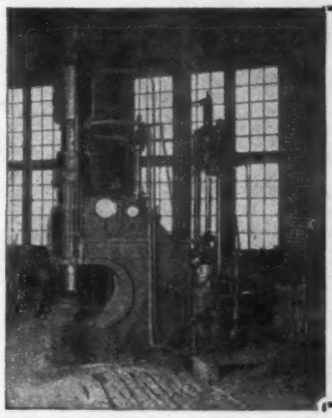

High Speed Steam Hydraulic Forging Press

See advertisement on Page 45, January 1st issue of "The Iron Trade Review."

United Engineering & Foundry Co.
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SCIENTIFICALLY HEAT TREATED
DROP FORGINGS
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SEND US PRINTS OR MODELS FOR PRICES
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Axles For Passenger or Freight Cars and Locomotives
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Kropp Forge Co., Chicago, Ill.
Norton Grinding Co., Worcester, Mass.

CRUCIBLES.
Dixon, Joseph, Crucible Co., Jersey City, N. J.

CUPOLAS.
Northern Engineering Works, Detroit, Mich.
Whiting Foundry Equipment Co., Harvey, Ill.

CUTTERS.
Landis Tool Co., Waynesboro, Pa.
Mark Mfg. Co., Evanston, Ill.

CUTTERS.
(Milling.)
Morse Twist Drill & Mch. Co.
New Bedford, Mass.

CUTTERS.
(Pipe.)
Trimont Mfg. Co., Boston, Mass.

CUTTING.
(Electric Arc.)
Westinghouse Electric & Mfg. Co.,
East Pittsburgh, Pa.

CUTTING.
(Oxy-Acetylene Process.)
Linde Air Products Co., New York, N. Y.
Oxweld Acetylene Co., Chicago, Ill.

CYLINDERS.
National Tube Co., Pittsburgh, Pa.

DERRICKS.
American Bridge Co., New York, N. Y.
Dake Engine Co., Grand Haven, Mich.

DIES.
Jones & Lamson Mach. Co., Springfield, Mass.
Landis Machine Co., Waynesboro, Pa.
Long & Allstatter Co., Hamilton, O.
Mark Mfg. Co., Evanston, Ill.
Toledo Machine & Tool Co., Toledo, O.

DIE-PLATES AND WORLDES.
(Steel Wire Mills.)
Turner, Vaughn & Taylor Co.,
Cuyahoga Falls, O.

DOCKS.
(Ore.)
American Bridge Co., New York, N. Y.

DREDGES.
Thew Automatic Shovel Co., Lorain, O.

DRESSING.
(Belt.)
Dixon, Jos., Crucible Co., Jersey City, N. J.

DRILLS.
(Electric.)
Van Dorn & Dutton Co., Cleveland, O.

DRILLS.
(Multiple.)
Baush Machine Tool Co., Springfield, Mass.

DRILLS.
(Pneumatic.)
Allen, John F., Co., New York, N. Y.
Cleveland Pneumatic Tool Co., Cleveland, O.

DRILLS.
(Portable.)
Newton Mach. Tool Works, Inc.,
Philadelphia, Pa.

DRILLS.
(Twist.)
Morse Twist Drill & Machine Co.,
New Bedford, Mass.
Ryerson, Jos. T., & Son, Chicago, Ill.

DRIVERS.
(Pile.)
Industrial Works, Bay City, Mich.

DYNAMOS.
General Electric Co., Schenectady, N. Y.
Westinghouse Elec. & Mfg. Co.,
East Pittsburgh, Pa.

ELECTRICAL INSTRUMENTS
(Repaired and Tested.)
Stupakoff Laboratories, Pittsburgh, Pa.

ELECTRICAL WIRES AND CABLES.
American Steel & Wire Co., Chicago, Ill.

ELEVATORS.
Otis Elevator Co., Cleveland, O.
Ridgway & Son, Craig, Coatesville, Pa.
Whiting Foundry Equipment Co., Harvey, Ill.

ENGINEERS AND CONTRACTORS.
American Bridge Co., New York, N. Y.
Ayer & Lord Tie Co., Chicago, Ill.
Bellefontaine Bridge & Steel Co.,
Bellefontaine, O.
Blair Engineering Co., Chicago, Ill.
Brown Construction Co., The P. J., Cleveland.
Carroll Foundry & Machine Co., Bucyrus, O.
Eichleay, John Jr., Co., Pittsburgh, Pa.
Hartman, W. E., Chicago, Ill.
Hunt, Robert W., & Co., Chicago, Ill.
Laughlin, Alex., & Co., Pittsburgh, Pa.
McClintic-Marshall Co., Pittsburgh, Pa.
McClure, Geo. W., Son & Co., Pittsburgh, Pa.
McKee, Arthur G., Cleveland, O.
Mesta Machine Co., Pittsburgh, Pa.
Morgan Engineering Co., Alliance, O.
Rockwood Sprinkler Co., Worcester, Mass.
Searing & Coultas, Pittsburgh, Pa.
Smythe, The S. R., Co., Pittsburgh, Pa.
Swindell, Wm., & Bros., Pittsburgh, Pa.
Tod Co., Wm., Youngstown, O.
Turner, Vaughn & Taylor Co.,
Cuyahoga Falls, O.
United Engineering & Fdy. Co., Pittsburgh, Pa.
Wellman-Seaver-Morgan Co., Cleveland, O.
Woodmansee & Davidson, Inc., Chicago, Ill.

ENGINEERS AND CONTRACTORS.
(By-Product Coke Ovens.)
Hartman, W. E., Chicago, Ill.

ENGINES.
(Blowing.)
Mackintosh, Hemphill & Co., Pittsburgh, Pa.
Tod Co., Wm., Youngstown, O.

ENGINES.
(Corliss.)
Cooper, C. & G., Co., Mt. Vernon, O.
Mesta Machine Co., Pittsburgh, Pa.
Providence Engrg. Works, Providence, R. I.

ENGINES.
(Gas, Gasoline and Oil).
Cooper, C. & G., Co., Mt. Vernon, O.
Mesta Machine Co., Pittsburgh, Pa.
Tod Co., Wm., Youngstown, O.

ENGINES.
(Hoisting.)
Dake Engine Co., Grand Haven, Mich.
Vulcan Iron Works, Wilkesbarre, Pa.

ENGINES.
(Pneumatic.)
Detroit Hoist & Machine Co., Detroit, Mich.

ENGINES.
(Pumping.)
Tod Co., Wm., Youngstown, O.

ENGINES.
(Reversing.)
Mesta Machine Co., Pittsburgh, Pa.

ENGINES.
(Steam.)
Cooper, C. & G., Co., Mt. Vernon, O.
Dake Engine Co., Grand Haven, Mich.
Mackintosh, Hemphill & Co., Pittsburgh, Pa.
Phoenix Iron Works Co., Meadville, Pa.
Tod Co., Wm., Youngstown, O.
Vulcan Iron Works, Wilkesbarre, Pa.

EQUIPMENT.
(Lighting Plant.)
Smith Gas Power Co., The, Lexington, O.

EQUIPMENT.
(Rolling Mill.)
Bertsch & Co., Cambridge City, Ind.
Carroll Foundry & Machine Co., Bucyrus, O.
Mackintosh, Hemphill & Co., Pittsburgh, Pa.
Mesta Machine Co., Pittsburgh, Pa.
Morgan Construction Co., Worcester, Mass.
Morgan Engineering Co., Alliance, O.
Tod Co., Wm., Youngstown, O.
United Engineering & Fdy. Co., Pittsburgh, Pa.

EQUIPMENT.
(Welded Chain, Wire and Wire Nail Mills—Complete.)
Morgan Construction Co., Worcester, Mass.
Turner, Vaughn & Taylor Co.,
Cuyahoga Falls, O.

EYEBARS.
American Bridge Co., New York, N. Y.

EXTRACTORS.
(Tar.)
Smith Gas Power Co., The, Lexington, O.

FACINGS.
(Foundry.)
Dixon, Jos., Crucible Co., Jersey City, N. J.

FENCES.
(Woven Wire.)
American Steel & Wire Co., Chicago, Ill.

FENCE GATES.
American Steel & Wire Co., Chicago, Ill.

FENCE POSTS.
Ayer & Lord Tie Co., Chicago, Ill.
Jennison-Wright Co., The, Toledo, O.

FENCE POSTS.
(Steel.)
American Steel & Wire Co., Chicago, Ill.

FENCING.
Cambria Steel Co., Johnstown, Pa.
Youngstown Sheet & Tube Co.,
Youngstown, O.

FERRO-MANGANESE.
Blackwell, Geo. G., & Sons, Ltd.,
Liverpool, England.
Mohr, J. J., & Son, Philadelphia, Pa.
Pickands, Brown & Co., Chicago, Ill.
Rogers, Brown & Co., Cincinnati, O.
Samuel, Frank, Philadelphia, Pa.

FERRO-SILICON.
Blackwell, Geo. G., & Sons, Ltd.,
Liverpool, England.
Mohr, J. J., & Son, Philadelphia, Pa.
Pickands, Brown & Co., Chicago, Ill.
Rogers, Brown & Co., Cincinnati, O.
Samuel, Frank, Philadelphia, Pa.
Tennessee Coal, Iron & R. R. Co.,
Birmingham, Ala.

FILES.
Barnett, G. & H., Co., Philadelphia, Pa.
Disston & Sons, Inc., Henry, Philadelphia, Pa.
Montgomery & Co., New York, N. Y.
Nicholson File Co., Providence, R. I.

FILTERS.
Kennicott Co., The, Chicago Heights, Ill.

FITTINGS.
(Pipe.)
Best Mfg. Co., Pittsburgh, Pa.
Illinois Malleable Iron Co., Chicago, Ill.
National Tube Co., Pittsburgh, Pa.
Pittsburgh Piping & Equip. Co., Pittsburgh, Pa.
Pittsburgh Valve, Fdy. & Const. Co.,
Pittsburgh, Pa.
United Engrg. & Fdy. Co., Pittsburgh, Pa.

FLANGE PACKINGS.
(Leather.)
Graton & Knight Mfg. Co., The,
Worcester, Mass.

FLANGES.
Dart, E. M., Mfg. Co., Providence, R. I.
National Tube Co., Pittsburgh, Pa.

FLASKS.
Sterling Wheelbarrow Co., Milwaukee, Wis.

FLAT WIRE—FLAT COLD ROLLED STEEL.
American Steel & Wire Co., Chicago, Ill.

FLOORING.
(Bridge).
Youngstown Iron & Steel Co., Youngstown, O.

FLOORING.
(Creosoted Wood.)
Ayer & Lord Tie Co., Chicago, Ill.
Jennison-Wright Co., The, Toledo, O.

FLOUR-SPAR.
Rogers, Brown & Co., Cincinnati, O.

FLY WHEELS.
Jones & Laughlin Steel Co., Pittsburgh, Pa.
Mesta Machine Co., Pittsburgh, Pa.
Tod Co., Wm., Youngstown, O.

FORGINGS.
American Bridge Co., New York, N. Y.
American Iron & Steel Mfg. Co., Lebanon, Pa.
Bethlehem Steel Co., South Bethlehem, Pa.
Carnegie Steel Co., Pittsburgh, Pa.
Champion Mach. & Forging Co., Cleveland, O.
Columbus Forge & Iron Co., Columbus, O.
Drop Forging Co. of N. Y., Jersey City, N. J.
Eccles Co., Richard, Auburn, N. Y.
Ingalls-Shepard Forging Co., Chicago, Ill.
Jones & Laughlin Steel Co., Pittsburgh, Pa.
Kropp Forge Co., Chicago, Ill.
Martin Forging Co., H. J., Indianapolis, Ind.
Otis Steel Co., Cleveland, O.
Pollak Steel Co., Cincinnati, O.
Rockford Drop Forge Co., Rockford, Ill.

FORGINGS.
(Auto.)
General Drop Forge Co., Buffalo, N. Y.
Kropp Forge Co., Chicago, Ill.
Martin Forging Co., H. J., Indianapolis, Ind.

FORGINGS.
(Car and Locomotive.)
American Iron & Steel Mfg. Co., Lebanon, Pa.
Andrews Steel Co., Newport, Ky.
Cambria Steel Co., Johnstown, Pa.
Oliver Iron & Steel Co., Pittsburgh, Pa.

FORGINGS.
(Copper and Alloy Steel.)
Kropp Forge Co., Chicago, Ill.
Martin Forging Co., H. J., Indianapolis, Ind.

FORGINGS.
(Drop.)
Champion Mach. & Forging Co., Cleveland, O.
Columbus Forge & Iron Co., Columbus, O.
Drop Forging Co. of N. Y., Jersey City, N. J.
General Drop Forge Co., Buffalo, N. Y.
Ingalls-Shepard Forging Co., Chicago, Ill.
Martin Forging Co., H. J., Indianapolis, Ind.
Oliver Iron & Steel Co., Pittsburgh, Pa.
Racine Drop Forge Co., Racine, Wis.
Rockford Drop Forge Co., Rockford, Ill.

FOUNDRY EQUIPMENT AND SUPPLIES.
(Iron and Brass.)
Arcade Mfg. Co., Freeport, Ill.
Northern Engineering Works, Detroit, Mich.
Paxson, J. W., Co., Philadelphia, Pa.
Sterling Wheelbarrow Co., Milwaukee, Wis.
Whiting Foundry Equipment Co., Harvey, Ill.

FURNACES.
(Annealing.)
Hagan, Geo. J., Pittsburgh, Pa.
Kenworthy, Chas. F., Waterbury, Conn.
Quigley Furnace & Fdy. Co., New York, N. Y.
Swindell & Bros., Wm., Pittsburgh, Pa.
Whiting Fdy. Equipment Co., Harvey, Ill.

FURNACES.
(Billet and Plate Heating.)
Kenworthy, Chas. F., Waterbury, Conn.
Quigley Furnace & Foundry Co.,
New York, N. Y.

See Index to Advertisements for pages containing advertisements of companies listed above

FURNACES.
(Blast.)
Mackintosh, Hemphill & Co., Pittsburgh, Pa.
McClure, Son & Co., G. W., Pittsburgh, Pa.
McKee, Arthur G., Cleveland, O.
Riter-Conley Mfg. Co., Pittsburgh, Pa.
Tod Co., Wm., Youngstown, O.
Wellman-Seaver-Morgan Co., Cleveland, O.

FURNACES.
(Crucible.)
Laughlin & Co., Alex., Pittsburgh, Pa.
Whiting Fdy. Equipment Co., Harvey, Ill.

FURNACES.
(Electric.)
Crowley Co., Jno. A., New York City.

FURNACES.
(Forging.)
Kenworthy, Chas. F., Waterbury, Conn.
Quigley Furnace & Foundry Co.,
New York, N. Y.

FURNACES.
(Heat Testing.)
Kenworthy, Chas. F., Waterbury, Conn.
Quigley Furnace & Foundry Co.,
New York, N. Y.

FURNACES.
(Lead, Pot and Muffle Annealing, Wire Mills.)
Morgan Construction Co., Worcester, Mass.
Turner, Vaughn & Taylor Co.,
Cuyahoga Falls, O.

FURNACES.
(Melting.)
Whiting Foundry Equipment Co., Harvey, Ill.

FURNACES.
(Oil, Gas or Coke, Welding Chain Factories.)
Turner, Vaughn & Taylor Co.,
Cuyahoga Falls, O.

FURNACES.
(Open-Hearth.)
Smythe Co., S. R., Pittsburgh, Pa.
Whiting Foundry Equipment Co., Harvey, Ill.

FURNACES.
(Reheating.)
Morgan Construction Co., Worcester, Mass.

FURRING.
(Metal.)
Youngstown Iron & Steel Co., Youngstown, O.

GALVANIZING.
(Custom.)
McCance Bros. Co., Verona, Pa.

GASKETS.
(Leather.)
Graton & Knight Mfg. Co., The,
Worcester, Mass.

GAGES.
(Recording and Steam.)
Bristol Co., Waterbury, Conn.
Brown Instrument Co., Philadelphia, Pa.

GEAR CUTTING.
Bilgram Machine Works, Philadelphia, Pa.
Newton Machine Tool Works, Philadelphia, Pa.
Tod, Co., Wm., Youngstown, O.

GEARS.
Chicago Rawhide Mfg. Co., Chicago, Ill.
Dake Engine Co., Grand Haven, Mich.
Falk Co., The, Milwaukee, Wis.
Farrell Fdy. & Mch. Co., Ansonia, Conn.
Fawcus Machine Co., Pittsburgh, Pa.
Horsburgh & Scott Co., Cleveland, O.
Mackintosh, Hemphill & Co., Pittsburgh, Pa.
Mesta Machine Co., Pittsburgh, Pa.
New Process Gear Corpn., Syracuse, N. Y.
Nuttall, R. D., Co., Pittsburgh, Pa.
Taylor-Wharton Iron & Steel Co.,
Highbridge, N. J.
Tod Co., Wm., Youngstown, O.
United Engrg. & Fdy. Co., Pittsburgh, Pa.
Van Dorn & Dutton Co., Cleveland, O.

GEARS.
(Bevel.)
Chicago Rawhide Mfg. Co., Chicago, Ill.
Fawcus Machine Co., Pittsburgh, Pa.
Horsburgh & Scott Co., Cleveland, O.
New Process Gear Corpn., Syracuse, N. Y.
Nuttall, R. D., Co., Pittsburgh, Pa.
Tod Co., Wm., Youngstown, O.

GEARS.
(Cast Steel, Machine Molded.)
American Steel Foundries, Chicago, Ill.
Chicago Rawhide Mfg. Co., Chicago, Ill.
Horsburgh & Scott Co., Cleveland, O.
Mackintosh, Hemphill & Co., Pittsburgh, Pa.
Mesta Machine Co., Pittsburgh, Pa.
Nuttall, R. D., Co., Pittsburgh, Pa.
United Engrg. & Fdy. Co., Pittsburgh, Pa.

GEARS.
(Cut.)
Carroll Foundry & Machine Co., Bucyrus, O.
Chicago Rawhide Mfg. Co., Chicago, Ill.
Fawcus Machine Co., Pittsburgh, Pa.
Horsburgh & Scott Co., Cleveland, O.
Mesta Machine Co., Pittsburgh, Pa.
Morgan Construction Co., Worcester, Mass.
New Process Gear Corpn. Syracuse, N. Y.
Nuttall, R. D., Co., Pittsburgh, Pa.
Tod Co., Wm., Youngstown, O.
Van Dorn & Dutton Co., Cleveland, O.

GEARS.
(Double Helical Cut.)
Fawcus Machine Co., Pittsburgh, Pa.
Tod Co., Wm., Youngstown, O.

GEARS.
(Rawhide.)
Chicago Rawhide Mfg. Co., Chicago, Ill.
Horsburgh & Scott Co., Cleveland, O.
New Process Gear Corpn., Syracuse, N. Y.
Nuttall, R. D., Co., Pittsburgh, Pa.

GENERATORS.
(Direct and Alternating.)
Crocker-Wheeler Co., Ampere, N. J.
General Electric Co., Schenectady, N. Y.
Westinghouse Elec. & Mfg. Co.,
East Pittsburgh, Pa.

GENERATORS.
(Hydrogen.)
International Oxygen Co., New York, N. Y.

GENERATORS.
(Oxygen.)
International Oxygen Co., New York, N. Y.

GOGGLES.
Tilghman-Brooksbank Sand Blast Co.,
Philadelphia, Pa.

GRAPHITE.
Dixon, Jos., Crucible Co., Jersey City, N. J.

GRATES.
Green Engrg. Co., Chicago, Ill.

GRINDERS.
(Chain Die, Welded Chain Factories.)
Turner, Vaughn & Taylor Co.,
Cuyahoga, Falls, O.

GRINDERS.
(Electrical Driven.)
Cincinnati Electrical Tool Co., Cincinnati, O.

GRINDERS.
(Nail Machines, Knife, Wire Nail Mills.)
Turner, Vaughn & Taylor Co.,
Cuyahoga Falls, O.

GRINDERS.
(Pneumatic.)
Cleveland Pneumatic Tool Co., Cleveland, O.

GRINDING MACHINERY.
(Cylindrical.)
Norton Grinding Co., Worcester, Mass.

GRINDING WHEEL STAND.
(Bench Type.)
Norton Grinding Co., Worcester, Mass.

GRINDING WHEEL STAND.
(Floor Type.)
Norton Grinding Co., Worcester, Mass.

HAMMERS.
(Belt-Driven.)
Beaudry & Co., Inc., Boston, Mass.

HAMMERS.
(Drop.)
Alliance Machine Co., Alliance, O.
Bliss, E. W., Co., Brooklyn, N. Y.
Buffalo Fdy. & Machine Co., Buffalo, N. Y.
Chambersburg Engineering Co.,
Chambersburg, Pa.
Erie Foundry Co., Erie, Pa.
Morgan Engineering Co., Alliance, O.
Niles-Bement-Pond Co., New York, N. Y.
Toledo Machine & Tool Co., Toledo, O.
United Engineering & Fdy. Co., Pittsburgh, Pa.

HAMMERS.
(Drop Forging.)
Buffalo Foundry & Machine Co., Buffalo, N. Y.
Toledo Machine & Tool Co., Toledo, O.

HAMMERS.
(Foot and Power, Welded Chain Factories.)
Turner, Vaughn & Taylor Co.,
Cuyahoga Falls, O.

HAMMERS.
(Pneumatic.)
Cleveland Pneumatic Tool Co., Cleveland, O.
Ryerson, Joseph T., & Son, Chicago, Ill.

HAMMERS.
(Power.)
Beaudry & Co., Inc., Boston Mass.
Buffalo Foundry & Machine Co. Buffalo, N. Y.
Cleveland Punch & Shear Works Co.,
Cleveland, O.
Morgan Engineering Co., Alliance, O.
Toledo Machine & Tool Co., Toledo, O.

HAMMERS.
(Steam.)
Buffalo Foundry & Machine Co.,
Buffalo, N. Y.
Chambersburg Engineering Co.,
Chambersburg, Pa.
Erie Foundry Co., Erie, Pa.
Morgan Engineering Co., Alliance, O.
Niles-Bement-Pond Co., New York, N. Y.

HAND LEATHERS.
Graton & Knight Mfg. Co., The,
Worcester, Mass.

HANGERS.
Jones & Laughlin Steel Co., Pittsburgh, Pa.
New Departure Mfg. Co., Bristol, Conn.

HEADS.
(Dished.)
Worth Bros., Coatesville, Pa.

HEAT TREATING.
Racine Drop Forge Co., Racine, Wis.

HOISTS.
(Chain.)
Chisholm & Moore Mfg. Co., Cleveland, O.
Dake Engine Co., Grand Haven, Mich.

HOISTS.
(Compressed Air Geared.)
Dake Engine Co., Grand Haven, Mich.
Detroit Hoist & Machine Co., Detroit, Mich.
Whiting Fdy. Equipment Co., Harvey, Ill.

HOISTS.
(Electric.)
Alliance Machine Co., Alliance, O.
Browning Co., The, Cleveland, O.
Euclid Crane & Hoist Co., Euclid, O.
Mead-Morrison Mfg. Co., Boston Mass.
Morgan Engineering Co., Alliance, O.
Niles-Bement-Pond Co., New York, N. Y.
Northern Engineering Works, Detroit Mich.
Otis Elevator Co., New York, N. Y.
Pawling & Harnischfeger Co., Milwaukee, Wis.
Toledo Bridge & Crane Co., Toledo, O.
Whiting Foundry Equipment Co., Harvey, Ill.

HOISTS.
(Pneumatic.)
Dake Engine Co., Grand Haven, Mich.
Detroit Hoist & Machine Co., Detroit, Mich.
Northern Engineering Works, Detroit, Mich.
Ridgway & Son, Craig, Coatesville, Pa.
Whiting Foundry Equipment Co., Harvey, Ill.

HOOPS AND BANDS.
Bourne-Fuller Co., The, Cleveland, O.
Carnegie Steel Co., Pittsburgh, Pa.
Illinois Steel Co., Chicago, Ill.
Jones & Laughlin Steel Co., Pittsburgh, Pa.
McCance Bros. Co., Pittsburgh, Pa.
Ryerson, Joseph T., & Son, Chicago, Ill.
Scully Steel & Iron Co., Chicago, Ill.

HORSE SHOES AND CALKS.
American Steel & Wire Co., Chicago, Ill.

HOSE.
(Pneumatic.)
Cleveland Pneumatic Tool Co., Cleveland, O.

HYDRAULIC LEATHERS.
Graton & Knight Mfg. Co., The,
Worcester, Mass.

HYDROGEN.
International Oxygen Co., New York, N. Y.

IGNITION WIRE.
American Steel & Wire Co., Chicago, Ill.

INSTRUMENTS.
(Electric Indicating and Recording.)
Bristol Co., Waterbury, Conn.
Brown Instrument Co., Philadelphia, Pa.
Smith Gas Power Co., Lexington, O.

IRON.
(Basic—Bessemer—Malleable.)
Inland Steel Co., Chicago, Ill.
Pickands, Brown & Co., Chicago, Ill.

IRON.
(Cutting Apparatus.)
Newton Mach. Tool Works, Inc.,
Philadelphia, Pa.

IRON.
(Forging.)
Thomas Iron Co., Easton, Pa.

IRON.
(Foundry.)
Thomas Iron Co., Easton, Pa.

IRON.
(Malleable.)
Thomas Iron Co., Easton, Pa.

IRON.
(Pig.)
Baird & West, Detroit, Mich.
Bourne-Fuller Co., The, Cleveland, O.
Brier Hill Steel Co., Youngstown, O.
Carnegie Steel Co., Pittsburgh, Pa.
Columbus Iron & Steel Co., Columbus, O.
Domhoff & Joyce Co., The, Cincinnati, O.
Eaton, Rhodes & Co., Cincinnati, O.
Globe Iron Co., Jackson, O.
Hanna & Co., M. A., Cleveland, O.
Hillman & Sons Co., J. H., Pittsburgh, Pa.
Illinois Steel Co., Chicago, Ill.
La Belle Iron Works, Steubenville, O.
McKeefrey & Co., Leetonia, O.
Mitchell-Diggins Iron Co., Cadillac, Mich.
Mohr, J. J., & Son, Philadelphia, Pa.
Pickands, Brown & Co., Chicago, Ill.
Pickands, Mather & Co., Cleveland, O.
Republic Iron & Steel Co., Youngstown, O.
Rogers, Brown & Co., Cincinnati, O.
Samuel, Frank, Philadelphia, Pa.
Snyder & Co., W. P., Pittsburgh, Pa.
Stewart Iron Co., Ltd., Cleveland, O.
Superior Charcoal Iron Co.,
Grand Rapids, Mich.
Tenn. Coal Iron & R. R. Co.,
Birmingham, Ala.
Thomas Furnace Co., Milwaukee, Wis.
Thomas Iron Co., Easton, Pa.
Upson Nut Co., Cleveland, O.

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IRON.
(Staybolt.)
American Iron & Steel Mfg. Co., Lebanon, Pa.
Bourne-Fuller Co., The, Cleveland, O.

IRON AND STEEL.
(Galvanized.)
American Rolling Mill Co., Middletown, O.
American Sheet & Tin Plate Co., Pittsburgh, Pa.
Bourne-Fuller Co., The, Cleveland, O.
Brier Hill Steel Co., Youngstown, O.
Inland Steel Co., Chicago, Ill.
McCalla, Harod, Philadelphia, Pa.
Portsmouth Steel Co., Portsmouth, O.
Ryerson, Jos. T., & Son, Chicago, Ill.
Youngstown Sheet & Tube Co., Youngstown, O.

IRON AND STEEL.
(Norway and Swedish.)
Bourne-Fuller Co., The, Cleveland, O.
Scully Steel & Iron Co., Chicago, Ill.

IRON AND STEEL.
(Scrap.)
American Bridge Co., New York, N. Y.

JACKS.
(Hydraulic.)
Watson-Stillman Co., New York, N. Y.

JOINTS.
(Rail.)
Carnegie Steel Co., Pittsburgh, Pa.
Lackawanna Steel Co., Buffalo, N. Y.

KEYS
(Machine)
Moltrup Steel Products Co., Beaver Falls, Pa.

KEYS AND COTTERS.
(Machine.)
Standard Gauge Steel Co., Beaver Falls, Pa.

KEYSEATERS.
Baker Bros., Toledo, O.
Mitts & Merrill, Saginaw, Mich.

LACE LEATHER.
Graton & Knight Mfg. Co., The, Worcester, Mass.

LADLES.
Northern Engineering Works, Detroit, Mich.
Riter-Conley Mfg. Co., Pittsburgh, Pa.
Whiting Foundry Equipment Co., Harvey, Ill.

LAMPS.
(Arc.)
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

LAMPS.
(Incandescent.)
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

LATH.
(Expanded Metal.)
American Sheet & Tin Plate Co., Pittsburgh, Pa.
Brier Hill Steel Co., The, Youngstown, O.
Youngstown Iron & Steel Co., Youngstown, O.

LATHES.
Cincinnati Iron & Steel Co., Cincinnati, O.
Jones & Lamson Mach. Co., Springfield, Vt.
Manning, Maxwell & Moore, Inc., New York, N. Y.
Niles-Bement-Pond Co., New York, N. Y.

LATHES.
(Roll.)
Mesta Machine Co., Pittsburgh, Pa.
Morgan Engineering Co., Alliance, O.
Morgan Construction Co., Worcester, Mass.
Niles-Bement-Pond Co., New York, N. Y.
Youngstown Fdy. & Mach. Co., Youngstown, O.

LATHES.
(Turret.)
Jones & Lamson Mach. Co., Springfield, Vt.
New Britain Mach. Co., New Britain, Conn.
Niles-Bement-Pond Co., New York, N. Y.

LEATHER BELTING.
(Steam and Waterproof.)
Graton & Knight Mfg. Co., The, Worcester, Mass.

LINE MATERIAL.
(Telegraph and Telephone.)
Inland Steel Co., Chicago, Ill.
National Tube Co., Pittsburgh, Pa.

LINING.
(Cupola.)
Louisville Fire Brick Works, Highland Park, Ky.

LINING.
(Forge and Furnace.)
Harbison-Walker Refractories Co., Pittsburgh, Pa.

LOCOMOTIVES.
Atlas Car & Mfg. Co., Cleveland, O.
General Electric Co., Schenectady, N. Y.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Vulcan Iron Works, Wilkesbarre, Pa.

LOCOMOTIVES.
(Electric.)
Atlas Car & Mfg. Co., Cleveland, O.
General Electric Co., Schenectady, N. Y.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

LOCOMOTIVES.
(Industrial.)
Vulcan Iron Works, Wilkesbarre, Pa.

LUBRICANTS.
Dixon, Jos., Crucible Co., Jersey City, N. J.

LUMBER.
(Boxing, Crating, Flask and Pattern.)
Johnson Lumber Co., Milwaukee, Wis.

LUMBER.
(Creosoted.)
Ayer & Lord Tie Co., Chicago, Ill.
Jennison-Wright Co., The, Toledo, O.

MACHINERY.
Pettler & Son, P., Beaver Falls, Pa.

MACHINERY.
(Automatic Gear Cutting.)
Newton Mch. Tool Works, Inc., Philadelphia, Pa.

MACHINERY.
(Barb Wire Fence, Barb Nail Wire, Wire Mills.)
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

MACHINERY.
(Bending and Straightening.)
Bertsch & Co., Cambridge City, Ind.
Birdsboro Steel Fdy. & Mach. Co., Birdsboro, Pa.
Cleveland Punch & Shear Works Co., Cleveland, O.
Espen-Lucas Machine Works, Philadelphia, Pa.
Hydraulic Press Mfg. Co., Mt. Gilead, O.
Long & Allstatter Co., Hamilton, O.
Mackintosh, Hemphill & Co., Pittsburgh, Pa.
Morgan Engineering Co., Alliance, O.
Niles-Bement-Pond Co., New York, N. Y.
United Engineering & Fdy. Co., Pittsburgh.
Watson-Stillman Co., New York, N. Y.

MACHINERY.
(Bolt and Nut.)
Landis Machine Co., Waynesboro, Pa.
National Machinery Co., Tiffin, O.
Newton Mach. Tool Works, Inc., Philadelphia.
Williams Tool Co., Erie, Pa.

MACHINERY.
(Boring and Turning.)
Baker Bros., Toledo, O.
Cincinnati Planer Co., Cincinnati, O.
Espen-Lucas Machine Works, Philadelphia, Pa.
Mitts & Merrill, Saginaw, Mich.
Newton Mach. Tool Wks., Inc., Philadelphia.
Niles-Bement-Pond Co., New York, N. Y.
Warner & Swasey Co., Cleveland, O.

MACHINERY.
(Cement.)
Vulcan Iron Works, Wilkesbarre, Pa.

MACHINERY.
(Coal and Ash Handling.)
Orton & Steinbrenner Co., Chicago, Ill.

MACHINERY.
(Coil and Trace Chain, Welded Chain Factories.)
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

MACHINERY.
(Coping.)
Newton Mch. Tool Wks. Inc., Philadelphia.

MACHINERY.
(Crushing.)
Vulcan Iron Works, Wilkesbarre, Pa.

MACHINERY.
(Cutting Off—Cold Metal.)
Birdsboro Steel Fdy. & Mch. Co., Birdsboro, Pa.
Cleveland Punch & Shear Works Co., Cleveland, O.
Espen-Lucas Machine Works, Philadelphia, Pa.
Newton Mach. Tool Wks., Inc., Philadelphia.

MACHINERY.
(Drilling.)
Baush Machine Tool Co., Springfield, Mass.
National Machinery Co., The, Tiffin, O.
Newton Mach. Tool Wks., Inc., Philadelphia.
Niles-Bement-Pond Co., New York, N. Y.

MACHINERY.
(Drilling and Boring, Horizontal.)
Newton Mach. Tool Works, Inc., Philadelphia, Pa.

MACHINERY.
(Drilling, Multiple.)
Baush Machine Tool Co., Springfield, Mass.
Newton Mach. Tool Works, Inc., Philadelphia, Pa.
Niles-Bement-Pond Co.,New York, N. Y.

MACHINERY.
(Drilling, Radial.)
Baush Machine Tool Co., Springfield, Mass.
Newton Mach. Tool Wks., Inc., Philadelphia, Pa.
Niles-Bement-Pond Co., New York, N. Y.

MACHINERY.
(Electrical.)
Moore, Edgar M., & Co., Pittsburgh, Pa.

MACHINERY.
(Electric Welding.)
Thomson Electric Welding Co., Lynn, Mass.
Toledo Electric Welder Co., Toledo, O.
Westinghouse Electric & Mfg. Co., Cincinnati, O.

MACHINERY.
(Elevating and Conveying.)
Brown Hoisting Machinery Co., Cleveland, O.
McMyler Interstate Co., Cleveland, O.
Mead-Morrison Mfg. Co., New York, N. Y.
Vulcan Iron Works, Wilkesbarre, Pa.
Wellman-Seaver-Morgan Co., Cleveland, O.

MACHINERY.
(Forging.)
Bethlehem Steel Co., South Bethlehem, Pa.
Bliss Co., E. W., Brooklyn, N. Y.
Mesta Machine Co., Pittsburgh, Pa.
Morgan Engineering Co., Alliance, O.
Tod Co., Wm., Youngstown, O.
United Engrg. & Fdy. Co., Pittsburgh, Pa.

MACHINERY.
(Galvanizing.)
Erie Foundry Co., Erie, Pa.

MACHINERY.
(Gear Cutting.)
Bilgram Machine Works, Philadelphia, Pa.
Newton Machine Tool Works, Inc., Philadelphia, Pa.

MACHINERY.
(Grinding.)
Blake & Johnson Co., Waterbury, Conn.
Landis Tool Co., Waynesboro, Pa.
Newton Mch. Tool Works, Inc., Philadelphia, Pa.
Norton Grinding Co., Worcester, Mass.

MACHINERY.
(Hydraulic.)
Hydraulic Press Mfg. Co., Mt. Gilead, O.
Mesta Machine Co., Pittsburgh, Pa.
Tod Co., Wm., Youngstown, O.
United Engrg. & Fdy. Co., Pittsburgh, Pa.
Watson-Stillman Co., New York, N. Y.

MACHINERY.
(Milling.)
Cincinnati Milling Mach. Co., Cincinnati, O.
Espen-Lucas Machine Works, Philadelphia, Pa.
Newton Mch. Tool Wks., Inc., Philadelphia, Pa.
Niles-Bement-Pond Co., New York, N. Y.
Warner & Swasey Co., Cleveland, O.

MACHINERY.
(Mining.)
McMyler Interstate Co., Cleveland, O.
Thew Automatic Shovel Co., Lorain, O.

MACHINERY.
(Molding.)
Arcade Mfg. Co., Freeport, Ill.

MACHINERY.
(Natural Gas.)
Moore, Edgar M., & Co., Pittsburgh, Pa.

MACHINERY.
(Nut Facing.)
Newton Mch. Tool Wks., Inc., Philadelphia, Pa.

MACHINERY.
(Pipe Mill.)
Landis Machine Co., Waynesboro, Pa.
Standard Engineering Co., Ellwood City, Pa.
United Engrg. & Fdy. Co., Pittsburgh, Pa.
Williams Tool Co, Erie, Pa.

MACHINERY.
(Planing.)
Newton Mch. Tool Wks., Inc., Philadelphia, Pa.

MACHINERY.
(Power Transmission.)
Jones & Laughlin Steel Co., Pittsburgh, Pa.
Mesta Machine Co., Pittsburgh, Pa.
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.

MACHINERY.
(Rolling Mill.)
Alliance Machine Co., Alliance, O.
Bertsch & Co., Cambridge City, Ind.
Birdsboro Steel Fdy. & Mch. Co., Birdsboro, Pa.
Blake & Johnson Co., Waterbury, Conn.
Carroll Foundry & Machine Co., Bucyrus, O.
Farrell Foundry & Mach. Co., Ansonia, Conn.
Fawcus Machine Co., Pittsburgh, Pa.
Garrison, A., Foundry Co., Pittsburgh, Pa.
Hyde Park Fdy. & Mach. Co., Hyde Park, Pa.
Mackintosh, Hemphill & Co., Pittsburgh, Pa.
Mesta Machine Co., Pittsburgh, Pa.
Morgan Construction Co., Worcester, Mass.
Morgan Engineering Co., Alliance, O.
Newbold, R. S., & Son Co., Norristown, Pa.
Standard Engineering Co., Ellwood City, Pa.
Tod Co., Wm., Youngstown, O.
United Engrg. & Fdy. Co., Pittsburgh, Pa.
Wellman-Seaver-Morgan Co., Cleveland, O.
Wheeling Mold & Fdy. Co., Pittsburgh, Pa.
Youngstown Fdy. & Mch. Co., Youngstown, O.

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MACHINERY.
(Screw Making, Automatic.)
Cook Co., Asa S., Hartford, Conn.

MACHINERY.
(Second Hand.)
Moore, Edgar M., & Co., Pittsburgh, Pa.
Niles-Bement-Pond Co., New York, N. Y.
Pettler & Son, P., Beaver Falls, Pa.
Ryerson, Jos. T., & Son, Chicago, Ill.

MACHINERY.
(Shearing.)
Bertsch & Co., Cambridge City, Ind.
Erie Foundry Co., Erie, Pa.
Mesta Machine Co., Pittsburgh, Pa.

MACHINERY.
(Sheet Metal Working.)
Bertsch & Co., Cambridge City, Ind.
Bliss Co., E. W., Brooklyn, N. Y.

MACHINERY.
(Steam.)
Moore, Edgar M., & Co., Pittsburgh, Pa.

MACHINERY.
(Shovel.)
Bertsch & Co., Cambridge City, Ind.

MACHINERY.
(Special.)
Long & Allstatter Co., Hamilton, O.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY.
(Spike and Rivet.)
Youngstown Fdy. & Mch. Co., Youngstown, O.

MACHINERY.
(Tapping.)
Baker Bros., Toledo, O.

MACHINERY.
(Thread Rolling.)
Blake & Johnson Co., Waterbury, Conn.

MACHINERY.
(Tin House.)
Birdsboro Steel Fdy. & Mch. Co., Birdsboro, Pa.
United Engrg. & Fdy. Co., Pittsburgh, Pa.

MACHINERY.
(Wire.)
Blake & Johnson Co., Waterbury, Conn.

MACHINERY.
(Wire Drawing, Wire and Rivet Works.)
Morgan Construction Co., Worcester, Mass.
Turner, Vaughn & Taylor Co.,
Cuyahoga Falls, O.

MACHINERY.
(Wire Galvanizing, Wire Tinning, Wire Nails.)
Turner, Vaughn & Taylor Co.,
Cuyahoga Falls, O.

MACHINERY.
(Wire Nail.)
National Machinery Co., Tiffin, O.

MACHINERY.
(Wire Nails and Staples, Wire Nail Mills.)
Kilby Mfg. Co., Cleveland, O.
Turner, Vaughn & Taylor Co.,
Cuyahoga Falls, O.

MACHINISTS.
(Special Machinery.)
Bethlehem Steel Co., South Bethlehem, Pa.
Blake & Johnson Co., Waterbury, Conn.
Bliss Co., E. W., Brooklyn, N. Y.
Carroll Foundry & Machine Co., Bucyrus, O.
Fawcus Machine Co., Pittsburgh, Pa.
Kilby Mfg. Co., Cleveland, O.
Manning, Maxwell & Moore, Inc.,
New York, N. Y.
Mesta Machine Co., Pittsburgh, Pa.
Morgan Engineering Co., Alliance, O.
Providence Engrg. Works, Providence, R. I.
Tod Co., Wm., Youngstown, O.
Toledo Machine & Tool Co., Toledo, O.
Torrington Mfg. Co., Torrington, Conn.

MAGNESITE.
(Dead Burned.)
American Refractories Co., Chicago, Ill.

MAGNETS.
(Electric Lifting.)
Electric Controller & Mfg. Co., Cleveland, O.

METALS.
(Antimony, Copper.)
Blackwell, Geo. G., Sons & Co.,
Liverpool, Eng.

METAL.
(Babbitt.)
American Metal Co., Pittsburgh, Pa.

METAL.
(Expanded.)
Youngstown Iron & Steel Co., Youngstown, O.

METAL.
(Heat Treatment Of.)
Steel Improvement Co., Cleveland, O.

METAL.
(Infusion Process For.)
Steel Improvement Co., Cleveland, O.

METAL.
(Non-Ferrous.)
Titanium Alloy Mfg. Co., Niagara Falls, N. Y.

METAL.
(Perforated.)
Erdle Perforating Co., Rochester, N. Y.
Hendricks Mfg. Co., Carbondale, Pa.

METAL.
(Washed.)
Brier Hill Steel Co., The, Youngstown, O.

METALLURGISTS.
Steel Improvement Co., Cleveland, O.

MILLS.
(Billet.)
Morgan Construction Co., Worcester, Mass.

MILLS.
(Blooming, Universal, Plate, Sheet, Tin, Bar.)
Mesta Machine Co., Pittsburgh, Pa.

MILLS.
(Continuous Rolling.)
Morgan Construction Co., Worcester, Mass.

MILLS.
(Wire Complete Equipment.)
Blake & Johnson Co., Waterbury, Conn.
Morgan Construction Co., Worcester, Mass.
Turner, Vaughn & Taylor Co.,
Cuyahoga Falls, O.

MOLDING MACHINES.
Pridmore, Henry E., Chicago, Ill.

MOLDS.
(Ingot.)
Carnegie Steel Co., Pittsburgh, Pa.
Marshall Foundry Co., Pittsburgh, Pa.

MOTORS.
(Air.)
Detroit Hoist & Machine Co., Detroit, Mich.
Westinghouse Elec. & Mfg. Co.,
East Pittsburgh, Pa.

MOTORS.
(Electric D. C. and A. C.)
Crocker-Wheeler Co., Ampere, N. J.
General Electric Co., Schenectady, N. Y.
Moore, Edgar M., & Co., Pittsburgh, Pa.
Westinghouse Electric & Mfg. Co.,
East Pittsburgh, Pa.

MOTORS.
(Mill.)
Crocker-Wheeler Co., Ampere, N. J.
General Electric Co., Schenectady, N. Y.
Westinghouse Electric & Mfg. Co.,
East Pittsburgh, Pa.

NAILS.
(Wire.)
American Steel & Wire Co., Chicago, Ill.
Cambria Steel Co., Johnstown, Pa.
Jones & Laughlin Steel Co., Pittsburgh, Pa.
La Belle Iron Works, Steubenville, O.
Newport Rolling Mill Co., Newport, Ky.
Youngstown Sheet & Tube Co., Youngstown, O.

NIPPLES.
National Tube Co., Pittsburgh, Pa.

NUTS.
American Bridge Co., New York, N. Y.
American Iron & Steel Co., Lebanon, Pa.
Bourne-Fuller Co., Cleveland, O.
Lockhart Iron & Steel Co., McKees Rocks, Pa.
Milton Mfg. Co., Milton, Pa.
Oliver Iron & Steel Co., Pittsburgh, Pa.
Republic Iron & Steel Co., Youngstown, O.
Russell, Burdsall & Ward Bolt & Nut Co.,
Port Chester, N. Y.
Scully Steel & Iron Co., Chicago, Ill.
Upson Nut Co., Cleveland, O.

NUTS.
(Hot Pressed.)
American Iron & Steel Mfg. Co., Lebanon, Pa.
Bourne-Fuller Co., Cleveland, O.
Milton Mfg. Co., Milton, Pa.
Republic Iron & Steel Co., Youngstown, O.
Upson Nut Co., Cleveland, O.

OIL STORAGE TANKS.
Kennicott Co., The, Chicago Heights, Ill.

ORE.
(Chrome.)
Blackwell, Geo. G., Sons & Co., Ltd.,
Liverpool, Eng.
Samuel, Frank, Philadelphia, Pa.

ORE.
(Iron.)
Blackwell, Geo. G., Sons & Co., Ltd.,
Liverpool, Eng.
Breitung, E. N., & Co., Cleveland, O.
Hanna, M. A., & Co., Cleveland, O.
Hillman & Sons Co., J. H., Pittsburgh, Pa.
La Belle Iron Works, Steubenville, O.
Oglebay, Norton & Co., Cleveland, O.
Pickands, Brown & Co., Chicago, Ill.
Pickands, Mather & Co., Cleveland, O.
Snyder & Co., W. P., Pittsburgh, Pa.
Tod-Stambaugh Co., Cleveland, O.

OVENS.
(Core.)
Quigley Furnace & Foundry Co.,
New York, N. Y.
Whiting Fdy. Equipment Co., Harvey, Ill.

OXYGEN.
International Oxygen Co., New York, N. Y.
Linde Air Products Co., New York City.

OXYGEN WELDING AND CUTTING APPARATUS.
International Oxygen Co., New York, N. Y.

PACKINGS.
(Leather.)
Graton & Knight Mfg. Co., Worcester, Mass.

PACKING.
(Metallic.)
American Metal Co., Pittsburgh, Pa.

PAINT.
American Cold Japan Co., Pittsburgh, Pa.
Dixon, Jos., Crucible Co., Jersey City, N. J.

PANELS.
(Current Limit, Protective.)
Electric Controller & Mfg. Co., Cleveland, O.

PANS.
(Grinding.)
Phillips & McLaren Co., Philadelphia, Pa.

PANS.
(Lathe.)
New Britain Machine Co., New Britain, Conn.

PANS.
(Shop.)
American Bridge Co., New York, N. Y.

PATTERNS.
Arcade Mfg. Co., Freeport, Ill.
Buffalo Fdy. & Mch. Co., Buffalo, N. Y.

PERFORATING.
(Sheet Metal, Automatic, Screen Work.)
Turner, Vaughn & Taylor Co.,
Cuyahoga Falls, O.

PILING.
(Creosoted.)
Ayer & Lord Tie Co., Chicago, Ill.
Jennison-Wright Co., The, Toledo, O.

PILING.
(Steel Sheet Interlocking.)
Carnegie Steel Co., Pittsburgh, Pa.
Jones & Laughlin Steel Co., Pittsburgh, Pa.
Lackawanna Steel Co., Buffalo, N. Y.

PINIONS.
Mesta Machine Co., Pittsburgh, Pa.
Nuttall, R. D., Co., Pittsburgh, Pa.
Tod Co., Wm., Youngstown, O.
Van Dorn & Dutton Co., Cleveland, O.

PINIONS.
(Mill Cut.)
Tod Co., Wm., Youngstown, O.

PINIONS.
(Rawhide.)
Chicago Rawhide Mfg. Co., Chicago, Ill.
Horsburgh & Scott Co., Cleveland, O.
New Process Gear Corpn., Syracuse, N. Y.
Nuttall, R. D., Co., Pittsburgh, Pa.

PINS.
(Knuckle and Brake.)
Champion Rivet Co., Cleveland, O.
Oliver Iron & Steel Co., Pittsburgh, Pa.

PIN.
(Pivot.)
Champion Rivet Co., Cleveland, O.

PIPE.
Bourne-Fuller Co., Cleveland, O.
Central Tube Co., Pittsburgh, Pa.
Inland Steel Co., Chicago, Ill.
La Belle Iron Works, Steubenville, O.
Mark Mfg. Co., Evanston, Ill.
National Tube Co., Pittsburgh, Pa.
Pittsburgh Valve Foundry & Construction Co.,
Pittsburgh, Pa.
Republic Iron & Steel Co., Youngstown, O.
U. S. Cast Iron Pipe & Fdy. Co.,
New York, N. Y.
Youngstown Sheet & Tube Co., Youngstown, O.

PIPE.
(Bending.)
Best Mfg. Co., Pittsburgh, Pa.

PIPE.
(Drive, Iron and Steel.)
National Tube Co., Pittsburgh, Pa.
Republic Iron & Steel Co., Youngstown, O.
Youngstown Sheet & Tube Co., Youngstown, O.

PIPE.
(Iron and Steel, Galvanized.)
National Tube Co., Pittsburgh, Pa.
Mark Mfg. Co., Evanston, Ill.
Youngstown Sheet & Tube Co., Youngstown, O.

PIPE.
(Line, Iron and Steel.)
National Tube Co., Pittsburgh, Pa.
Youngstown Sheet & Tube Co., Youngstown, O.

PIPE.
(Riveted Steel.)
American Bridge Co., New York, N. Y.
Cambria Steel Co., Johnstown, Pa.
Kennicott Co., The, Chicago Heights, Ill.
Riter-Conley Mfg. Co., Pittsburgh, Pa.

PIPE.
(Wrought Iron.)
Bourne-Fuller Co., Cleveland, O.
Pittsburgh Piping & Equip. Co., Pittsburgh.
Youngstown Sheet & Tube Co., Youngstown, O.

PIPING.
(Power.)
Best Mfg. Co., Pittsburgh, Pa.

PLANERS.
Cincinnati Planer Co., Cincinnati, O.
Cleveland Punch & Shear Works Co.,
Cleveland, O.
Manning, Maxwell & Moore, Inc.,
New York, N. Y.
Niles-Bement-Pond Co., New York, N. Y.
Ryerson, Jos. T., & Son, Chicago, Ill.

See Index to Advertisements for pages containing advertisements of companies listed above

PLANTS.
(Electric Lighting.)
Smith Gas Power Co., The, Lexington, O.

PLANTS.
(Powdered Coal.)
Quigley Furnace & Foundry Co., New York, N. Y.

PLATES.
Allegheny Steel Co., Pittsburgh, Pa.
Bourne-Fuller Co., Cleveland, O.
Cambria Steel Co., Johnstown, Pa.
Carbon Steel Co., Pittsburgh, Pa.
Carnahan Tin Plate & Sheet Co., Canton, O.
Illinois Steel Co., Chicago, Ill.
Illinois Steel Co., Warehouse Dept., Chicago, Ill.
Illinois Steel Warehouse Co., St. Louis, Mo.
Illinois Steel Warehouse Co., St. Paul, Minn.
Inland Steel Co., Chicago, Ill.
Jones & Laughlin Steel Co., Pittsburgh, Pa.
La Belle Iron Works, Steubenville, O.
Lackawanna Steel Co., Buffalo, N. Y.
Otis Steel Co., Cleveland, O.
Portsmouth Steel Co., Cleveland, O.
Republic Iron & Steel Co., Youngstown, O.
Ryerson, Jos. T., & Son, Chicago, Ill.
Taylor, N. & G., Co., Philadelphia, Pa.
Tenn. Coal, Iron & R. R. Co., Birmingham, Ala.
Wood, Alan, Iron & Steel Co., Philadelphia, Pa.
Worth Bros. Co., Coatesville, Pa.
Youngstown Sheet & Tube Co., Youngstown, O.

PLATES.
(Boiler and Tank.)
American Rolling Mill Co., Middletown, O.
Bourne-Fuller Co., Cleveland, O.
Brown-Wales Co., Boston, Mass.
La Belle Iron Works, Steubenville, O.
Otis Steel Co., Cleveland, O.
Portsmouth Steel Co., Portsmouth, O.
Ryerson & Son, Jos. T., Chicago, Ill.

PLATES.
(Felloe.)
Wrought Washer Mfg. Co., Milwaukee, Wis.

PLATES.
(Floor, Rolled Steel.)
Carnegie Steel Co., Pittsburgh, Pa.
National Tube Co., Pittsburgh, Pa.
Wood, Alan, Iron & Steel Co., Philadelphia, Pa.

PLATES.
(Name.)
Chandler Co., Springfield, Mass.

PLATES.
(Sheared.)
American Rolling Mill Co., Middletown, O.
Bourne-Fuller Co., Cleveland, O.
Cambria Steel Co., Johnstown, Pa.
Carnegie Steel Co., Pittsburgh, Pa.
Cincinnati Iron & Steel Co., Cincinnati, O.
Illinois Steel Co., Chicago, Ill.
Portsmouth Steel Co., Portsmouth, O.

PLATES.
(Terne.)
Carnahan Tin Plate & Sheet Co., Canton, O.

PLATES.
(Tie.)
Illinois Steel Co., Chicago, Ill.
Lackawanna Steel Co., Buffalo, N. Y.

PLATES.
(Universal.)
Bourne-Fuller Co., Cleveland, O.
Carnegie Steel Co., Pittsburgh, Pa.
Illinois Steel Co., Chicago, Ill.
La Belle Iron Works, Steubenville, O.
United Steel Co., Canton, O.
Youngstown Sheet & Tube Co., Youngstown, O.

POINTERS.
(Wire Rod, Wire Mills.)
Morgan Construction Co., Worcester, Mass.
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

POLES.
(Gin.)
American Bridge Co., New York, N. Y.

POTS.
(Galvanizing.)
American Bridge Co., New York, N. Y.

POULTRY NETTING.
American Steel & Wire Co., Chicago, Ill.

PRESSES.
Birdsboro Steel Fdy. & Mch. Co., Birdsboro, Pa.
Bliss, E. W., Co., Brooklyn, N. Y.
Chambersburg Engrg. Co., Chambersburg, Pa.
Cleveland Punch & Shear Works Co., Cleveland, O.
Mackintosh, Hemphill & Co., Pittsburgh, Pa.
Mesta Machine Co., Pittsburgh, Pa.
Morgan Engineering Co., Alliance, O.
Niles-Bement-Pond Co., New York, N. Y.
Ryerson, Jos. T., & Son, Chicago, Ill.
Tod Co., Wm., Youngstown, O.
United Engrg. & Fdy. Co., Pittsburgh, Pa.
Wood, R. D., & Co., Philadelphia, Pa.

PRESSES.
(Bending and Flanging.)
Chambersburg Engrg. Co., Chambersburg, Pa.
Hydraulic Press Mfg. Co., Mt. Gilead, O.
Mesta Machine Co., Pittsburgh, Pa.

PRESSES.
(Drill, Heavy Duty.)
Niles-Bement-Pond Co., New York, N. Y.

PRESSES.
(Drill, Multiple Spindle.)
Niles-Bement-Pond Co., New York, N. Y.

PRESSES.
(Forging.)
Chambersburg Engrg. Co., Chambersburg, Pa.
Mesta Machine Co., Pittsburgh, Pa.
Morgan Engineering Co., Worcester, Mass.
Tod Co., Wm., Youngstown, O.
United Engrg. & Fdy. Co., Pittsburgh, Pa.
Watson-Stillman Co., New York, N. Y.

PRESSES
(Hydraulic.)
Chambersburg Engrg. Co., Chambersburg, Pa.
Hydraulic Press Mfg. Co., Mt. Gilead, O.
Mesta Machine Co., Pittsburgh, Pa.
Niles-Bement-Pond Co., New York, N. Y.
Tod Co., Wm., Youngstown, O.
United Engrg. & Fdy. Co., Pittsburgh, Pa.
Watson-Stillman Co., New York, N. Y.

PRESSES.
(Power.)
Toledo Machine & Tool Co., Toledo, O.

PRESSES.
(Rail Straightening.)
Tod Co., Wm., Youngstown, O.

PRESSES.
(Steam, Sleeves, Runner Brick, Nozzle and Tuyeres, Fire Brick Works.)
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

PRESSES.
(Toggle Drawing.)
Toledo Machine & Tool Co., Toledo, O.

PRESSES.
(Trimming.)
Erie Foundry Co., Erie, Pa.
Toledo Machine & Tool Co., Toledo, O.

PRODUCERS.
(Gas.)
Chapman Engineering Co., Mt. Vernon, O.
Hagan Co., Geo. J., Pittsburgh, Pa.
Morgan Construction Co., Worcester, Mass.
Smith Gas Power Co., The, Lexington, O.
Wellman-Seaver, Morgan Co., Cleveland, O.

PULLEYS.
Jones & Laughlin Steel Co., Pittsburgh, Pa.

PUMP LEATHERS.
Graton & Knight Mfg. Co., The, Worcester, Mass.

PUMPS.
Aldrich Pump Co., Allentown, Pa.
Dean Bros. Steam Pump Wks., Indianapolis, Ind.
Deming Co., Salem, O.
Providence Engineering Wks., Providence, R. I.
Tod Co., Wm., Youngstown, O.

PUMPS.
(Bank.)
Dean Bros. Steam Pump Wks., Indianapolis, Ind.

PUMPS.
(Boiler Feed.)
Aldrich Pump Co., Allentown, Pa.
Dean Bros. Steam Pump Wks., Indianapolis, Ind.
Deming Co., Salem, O.
Providence Engineering Wks., Providence, R. I.
Vulcan Iron Works, Wilkesbarre, Pa.

PUMPS.
(Centrifugal.)
Providence Engineering Wks., Providence, R. I.

PUMPS.
(Compound.)
Dean Bros. Steam Pump Wks., Indianapolis, Ind.

PUMPS.
(Deep Well.)
Dean Bros. Steam Pump Wks., Indianapolis, Ind.
Deming Co., Salem, O.

PUMPS.
(Electric Driven.)
Aldrich Pump Co., Allentown, Pa.
Dean Bros. Steam Pump Wks., Indianapolis, Ind.
Deming Co., Salem, O.

PUMPS.
(Elevator.)
Aldrich Pump Co., Allentown, Pa.
Dean Bros. Steam Pump Wks., Indianapolis, Ind.

PUMPS.
(Hydraulic.)
Aldrich Pump Co., Allentown, Pa.
Chambersburg Engrg. Co., Chambersburg, Pa.
Dean Bros. Steam Pump Wks., Indianapolis, Ind.
Deming Co., Salem, O.
Hydraulic Press Mfg. Co., Mt. Gilead, O.

PUMPS.
(Mine.)
Aldrich Pump Co., Allentown, Pa.
Dean Bros. Steam Pump Wks., Indianapolis, Ind.
Deming Co., Salem, O.

PUMPS.
(Steam.)
Dean Bros. Steam Pump Wks., Indianapolis, Ind.

PUMPS.
(Vacuum.)
Buffalo Fdy. & Machine Co., Buffalo, N. Y.
Dean Bros. Steam Pump Works, Indianapolis, Ind.
Deming Co., Salem, O.
Mesta Machine Co., Pittsburgh, Pa.

PUNCHES AND SHEARS.
Allen, John F., Co., New York, N. Y.
Alliance Machine Co., Alliance, O.
Bertsch & Co., Cambridge City, Ind.
Birdsboro Steel Fdy. & Mach. Co., Birdsboro, Pa.
Bliss, E. W., Co., Brooklyn, N. Y.
Cleveland Punch & Shear Wks. Co., Cleveland, O.
Long & Allstatter Co., Hamilton, O.
Mackintosh, Hemphill & Co., Pittsburgh, Pa.
Massillon Fdy. & Machine Co., Massillon, O.
Morgan Engineering Co., Alliance, O.
Niles-Bement-Pond Co., New York, N. Y.
Ryerson, Jos. T., & Son, Chicago, Ill.
Scully Steel & Iron Co., Chicago, Ill.
Standard Bridge Tool Co., Pittsburgh, Pa.
Tod Co., Wm., Youngstown, O.
United Engrg. & Fdy. Co., Pittsburgh, Pa.
Watson-Stillman Co., New York, N. Y.
Wood, R. D., & Co., Philadelphia, Pa.

PUNCHES.
(Hand.)
Bertsch & Co., Cambridge City, Ind.
Bourne-Fuller Co., Cleveland, O.

PUNCHES.
(Hydraulic.)
Bertsch & Co., Cambridge City, Ind.
Mesta Machine Co., Pittsburgh, Pa.
Tod Co., Wm., Youngstown, O.
Watson-Stillman Co., New York, N. Y.

PUNCHES.
(Multiple.)
Bertsch & Co., Cambridge City, Ind.
Bliss Co., E. W., Brooklyn, N. Y.
Mackintosh, Hemphill & Co., Pittsburgh, Pa.

PUNCHES.
(Pneumatic.)
Allen, John F., Co., New York, N. Y.

PUNCHES.
(Structural and Boiler Work.)
Richards Co., I. P., Providence, R. I.

PYROMETERS.
Bristol Co., Waterbury, Conn.
Brown Instrument Co., Philadelphia, Pa.
Stupakoff Laboratories, Pittsburgh, Pa.

RACKS.
(Steel or Tool.)
New Britain Mach. Co., New Britain, Conn.

RAIL BONDS.
American Steel & Wire Co., Chicago, Ill.

RAILS.
Bourne-Fuller Co., Cleveland, O.
Cambria Steel Co., Johnstown, Pa.
Carnegie Steel Co., Pittsburgh, Pa.
Cincinnati Frog & Switch Co., Cincinnati, O.
Illinois Steel Co., Chicago, Ill.
Illinois Steel Co., Warehouse Dept., Chicago, Ill.
Illinois Steel Warehouse Co., St. Louis, Mo.
Illinois Steel Warehouse Co., St. Paul, Minn.
Jones & Laughlin Steel Co., Pittsburgh, Pa.
Lackawanna Steel Co., Buffalo, N. Y.
Tenn. Coal, Iron & R. R. Co., Birmingham, Ala.

REAMERS.
Morse Twist Drill & Mach. Co., New Bedford, Mass.

REELS.
(Wood and Iron, Wire Mills.)
Morgan Construction Co., Worcester, Mass.
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

REGULATORS.
(Automatic Pressure.)
Electric Controller & Mfg. Co., Cleveland, O.

RELAYS.
(Field Rheostat.)
Electric Controller & Mfg. Co., Cleveland, O.

RESISTANCE.
(Cast Grid and Coil.)
Electric Controller & Mfg. Co., Cleveland, O.

RHEOSTATS.
(Motor Field, Motor Starting.)
Electric Controller & Mfg. Co., Cleveland, O.

RIVETS.
Falls Rivet Co., Cuyahoga Falls, O.

RIVETS.
(Structural, Boiler, Ship.)
American Iron & Steel Mfg. Co., Lebanon, Pa.
Bourne-Fuller Co., Cleveland, O.
Champion Rivet Co., Cleveland, O.
Illinois Steel Co., Warehouse Dept., Chicago, Ill.
Illinois Steel Warehouse Co., St. Louis, Mo.
Illinois Steel Warehouse Co., St. Paul, Minn.
Inland Steel Co., Chicago, Ill.
Jones & Laughlin Steel Co., Pittsburgh, Pa.
Lockhart Iron & Steel Co., McKees Rocks, Pa.
Oliver Iron & Steel Co., Pittsburgh, Pa.
Pittsburgh Screw & Bolt Co., Pittsburgh, Pa.
Progressive Mfg. Co., Torrington, Conn.
Republic Iron & Steel Co., Youngstown, O.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Ryerson, Jos. T., & Son., Chicago, Ill.
Scully Steel & Iron Co., Chicago, Ill.
Upson Nut Co., Cleveland, O.

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RIVETERS.
(Hydraulic.)
Chambersburg Engrg. Co., Chambersburg, Pa.
Mackintosh, Hemphill & Co., Pittsburgh, Pa.
Morgan Engineering Co., Alliance, O.
Niles-Bement-Pond Co., New York, N. Y.
Wood & Co., R. D., Philadelphia, Pa.

RIVETERS.
(Pneumatic.)
Allen, John F., Co., New York, N. Y.
Cleveland Pneumatic Tool Co., Cleveland, O.
Ryerson, Jos. T., & Son., Chicago, Ill.

RODS.
(Drill, Polished.)
Bourne-Fuller Co., Cleveland, O.

RODS.
(Iron and Steel.)
American Iron & Steel Mfg. Co., Lebanon, Pa.
Jones & Laughlin Steel Co., Pittsburgh, Pa.
Upson Nut Co., Cleveland, O.
Youngstown Sheet & Tube Co., Youngstown, O.

RODS.
(Straightened and Cut.)
Youngstown Sheet & Tube Co., Youngstown, O.

RODS.
(Wire.)
American Steel & Wire Co., Chicago, Ill.

ROLL GRINDING MACHINE.
Landis Tool Co., Waynesboro, Pa.
Norton Grinding Co., Worcester, Mass.

ROLLS.
(Bending and Straightening.)
Bertsch & Co., Cambridge City, Ind.
Morgan Engineering Co., Alliance, O.
United Engrg. & Fdy. Co., Pittsburgh, Pa.

ROLLS.
(Sand Chilled and Steel.)
American Steel Foundries, Chicago, Ill.
Birdsboro Steel Fdy. & Mch. Co., Birdsboro, Pa.
Farrell Fdy. & Mach. Co., Ansonia, Conn.
Garrison, A., Foundry Co., Pittsburgh, Pa.
Hyde Park Fdy. & Mach. Co., Hyde Park, Pa.
Mesta Machine Co., Pittsburgh, Pa.
National Roll & Foundry Co., Avonmore, Pa.
Seaman, Sleeth & Co., Pittsburgh, Pa.
United Engrg. & Fdy. Co., Pittsburgh, Pa.
Youngstown Fdy. & Mach. Co., Youngstown, O.

ROOFING.
(Corrugated.)
American Rolling Mill Co., Middletown, O.
American Sheet & Tin Plate Co., Chicago, Ill.
Brier Hill Steel Co., Youngstown, O.
Inland Steel Co., Chicago, Ill.
Portsmouth Steel Co., Portsmouth, O.
Seneca Iron & Steel Co., Buffalo, N. Y.
Stark Rolling Mill Co., Canton, O.
Youngstown Sheet & Tube Co., Youngstown, O.

ROOFING.
(Iron and Steel.)
American Rolling Mill Co., Middletown, O.
American Sh't & Tin Plate Co., Pittsburgh, Pa.
Brier Hill Steel Co., Youngstown, O.
Inland Steel Co., Chicago, Ill.
Massillon Rolling Mill Co., Massillon, O.
Portsmouth Steel Co., Portsmouth, O.
Western Reserve Steel Co., Warren, O.
Wood, Alan, Iron & Steel Co., Philadelphia.
Youngstown Iron & Steel Co., Youngstown, O.
Youngstown Sheet & Tube Co., Youngstown, O.

ROOFING TIMBER.
(Creosoted.)
Ayer & Lord Tie Co., Chicago, Ill.
Jennison-Wright Co., The, Toledo, O.

RUNNING BALANCE INDICATING MACHINE.
Norton Grinding Co., Worcester, Mass.

RUNWAYS.
(Crane.)
American Bridge Co., New York, N. Y.

SAND.
(Molding.)
Ohio Sand Co., Conneaut, O.

SAND BLASTING.
Tilghman-Brooksbank Sand Blast Co., Philadelphia, Pa.

SAND BLAST.
(Chilled Shot for Use In.)
Globe Steel Co., Mansfield, O.

SAND BLAST ACCESSORIES.
Tilghman-Brooksbank Sand Blast Co., Philadelphia, Pa.

SAND BLAST EQUIPMENT.
Paxson Co., J. W., Philadelphia, Pa.
Sly, W. W., Mfg. Co., Cleveland, O.
Tilghman-Brooksbank Sand Blast Co., Philadelphia, Pa.

SAND BLAST TUMBLING BARRELS.
Tilghman-Brooksbank Sand Blast Co., Philadelphia, Pa.

SAWS.
(Band.)
Disston, Henry & Sons, Inc., Philadelphia, Pa.

SAWS.
(Cold Metal.)
Disston, Henry & Sons, Inc., Philadelphia, Pa.
Espen-Lucas Mach. Works, Philadelphia, Pa.
Mackintosh, Hemphill & Co., Pittsburgh, Pa.
Newton Mach. Tool Wks., Inc., Philadelphia, Pa.

SAWS.
(Hack.)
Disston, Henry & Sons, Inc., Philadelphia, Pa.
Mackintosh, Hemphill & Co., Pittsburgh, Pa.
Mesta Machine Co., Pittsburgh, Pa.
United Engrg. & Fdy. Co., Pittsburgh, Pa.

SAWS.
(Milling.)
Disston, Henry & Sons, Inc., Philadelphia, Pa.

SCREENS.
Hendrick Mfg. Co., Carbondale, Pa.

SCREWS.
American Iron & Steel Mfg. Co., Lebanon, Pa.
Milton Mfg. Co., Milton, Pa.
Progressive Mfg. Co., Torrington, Conn.
Republic Iron & Steel Co., Youngstown, O.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.

SEMI-UNIVERSAL GRINDING MACHINE.
Norton Grinding Co., Worcester, Mass.

SEPARATORS.
(Centrifugal Oil.)
American Tool & Machine Co., Boston, Mass.

SEPARATORS.
(Steam and Oil.)
Pittsburgh Valve Fdy. & Cons. Co., Pittsburgh, Pa.

SHAFTING.
Bourne-Fuller Co., Cleveland, O.
Cincinnati Iron & Steel Co., Cincinnati, O.
Cumberland Steel Co., Cumberland, Md.
Jones & Laughlin Steel Co., Pittsburgh, Pa.
Republic Iron & Steel Co., Youngstown, O.
Scully Steel & Iron Co., Chicago, Ill.
Standard Gauge Steel Co., Beaver Falls, Pa.
Union Drawn Steel Co., Beaver Falls, Pa.

SHAFTING.
(Cold Drawn or Rolled.)
Bourne-Fuller Co., Cleveland, O.
Republic Iron & Steel Co., Youngstown, O.

SHAFTING.
(Cold Rolled Steel.)
American Steel & Wire Co,, Chicago, Ill.

SHAFTING.
(Turned.)
Bourne-Fuller Co., Cleveland, O.

SHAPES.
(Agricultural.)
Carnegie Steel Co., Pittsburgh, Pa.
Inland Steel Co., Chicago, Ill.
Jones & Laughlin Steel Co., Pittsburgh, Pa.
Laclede Steel Co., St. Louis, Mo.
Republic Iron & Steel Co., Youngstown, O.

SHAPES.
(Automobile.)
Moltrup Steel Products Co., Beaver Falls, Pa.

SHAPES.
(Steel, Structural and Special Rolled.)
Bourne-Fuller Co., Cleveland, O.
Cambria Steel Co., Johnstown, Pa.
Illinois Steel Co., Chicago, Ill.
Moltrup Steel Products Co., Beaver Falls, Pa.
Scully Steel & Iron Co., Chicago, Ill.

SHAPERS.
Cleveland Punch & Shear Wks. Co., Cleveland, O.
Manning, Maxwell & Moore, Inc., New York, N. Y.
Newton Mch. Tool Wks., Inc., Philadelphia.
Niles-Bement-Pond Co., New York, N. Y.

SHEARS.
(Angle and Plate.)
Bertsch & Co., Cambridge City, Ind.

SHEARS.
(Billet, Bloom and Slab.)
Garrison, A., Foundry Co., Pittsburgh, Pa.
Mackintosh, Hemphill & Co., Pittsburgh, Pa.
Tod Co., Wm., Youngstown, O.
United Engrg. & Fdy. Co., Pittsburgh, Pa.

SHEARS.
(Doubling.)
Mesta Machine Co., Pittsburgh, Pa.

SHEARS.
(Flying and Bar.)
Mackintosh, Hemphill & Co., Pittsburgh, Pa.
Morgan Construction Co., Worcester, Mass.

SHEAR KNIVES.
L. & I. J. White Co., Buffalo, N. Y.

SHEARS.
(Lever.)
Bertsch & Co., Cambridge City, Ind.
Mesta Machine Co., Pittsburgh, Pa.
United Engrg. & Fdy. Co., Pittsburgh, Pa.
Watson-Stillman Co., New York, N. Y.
Youngstown Fdy. & Mch. Co., Youngstown.

SHEARS.
(Portable.)
Watson-Stillman Co., New York, N. Y.

SHEARS.
(Power.)
Toledo Machine & Tool Co., Toledo, O.

SHEARS.
(Scrap, Alligator, Wire and Wire Nail Mills.)
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.
Youngstown Fdy. & Mch. Co., Youngstown.

SHEARS.
(Squaring.)
Bertsch & Co., Cambridge City, Ind.
Bliss Co., E. W., Brooklyn, N. Y.
Erie Foundry Co., Erie, Pa.
Garrison, A., Foundry Co., Pittsburgh, Pa.
Mesta Machine Co., Pittsburgh, Pa.
Tod Co., Wm., Youngstown, O.
United Engrg. & Fdy. Co., Pittsburgh, Pa.

SHEARS.
(Vertical.)
Bertsch & Co., Cambridge City, Ind.
Mesta Machine Co., Pittsburgh, Pa.
Tod Co., Wm., Youngstown, O.
United Engrg. & Fdy. Co., Pittsburgh, Pa.

SHEETS.
(Black Steel.)
American Sheet & Tin Plate Co., Pittsburgh.
Bourne-Fuller Co., Cleveland, O.
Brier Hill Steel Co., Youngstown, O.
Canton Sheet Steel Co., Canton, O.
Cincinnati Iron & Steel Co., Cincinnati, O.
Inland Steel Co., Chicago, Ill.
Portsmouth Steel Co., Portsmouth, O.
Ryerson, Joseph T., & Son, Chicago, Ill.
Seneca Iron & Steel Co., Buffalo, N. Y.
Stark Rolling Mill Co., Canton, O.
Youngstown Iron & Steel Co., Youngstown.
Youngstown Sheet & Tube Co., Youngstown.

SHEETS.
(Blue Annealed.)
American Rolling Mill Co., Middletown, O.
American Sheet & Tin Plate Co., Pittsburgh.
Bourne-Fuller Co., Cleveland, O.
Brier Hill Steel Co., Youngstown, O.
Cincinnati Iron & Steel Co., Cincinnati, O
Inland Steel Co., Chicago, Ill.
Portsmouth Steel Co., Portsmouth, O.
Seneca Iron & Steel Co., Buffalo, N. Y.
Stark Rolling Mill Co., Canton, O.
Western Reserve Steel Co., Warren, O.
Youngstown Sheet & Tube Co., Youngstown.

SHEETS.
(Corrugated.)
American Rolling Mill Co., Middletown, O.
American Sheet & Tin Plate Co., Pittsburgh.
Bourne-Fuller Co., Cleveland, O.
Brier Hill Steel Co., Youngstown, O.
Canton Sheet Steel Co., Canton, O.
Cincinnati Iron & Steel Co., Cincinnati, O.
Inland Steel Co., Chicago, Ill.
La Belle Iron Works, Steubenville, O.
Portsmouth Steel Co., Portsmouth, O.
Ryerson, & Son, Joseph T., Chicago, Ill.
Seneca Iron & Steel Co., Buffalo, N. Y.
Stark Rolling Mill Co., Canton, O.
Trumbull Steel Co., Warren, O.
Youngstown Iron & Steel Co., Youngstown.
Youngstown Sheet & Tube Co., Youngstown.

SHEETS.
(Dead Soft for Stamping.)
American Rolling Mill Co., Middletown, O.
American Sheet & Tin Plate Co., Pittsburgh.
Bourne-Fuller Co., Cleveland, O.
Brier Hill Steel Co., Youngstown, O.
Canton Sheet Steel Co., Canton, O.
Inland Steel Co., Chicago, Ill.
Massillon Rolling Mill Co., Massillon, O.
Portsmouth Steel Co., Portsmouth, O.
Seneca Iron & Steel Co., Buffalo, N. Y.
Stark Rolling Mill Co., Canton, O.
Western Reserve Steel Co., Warren, O.
Youngstown Iron & Steel Co., Youngstown, O.
Youngstown Sh't & Tube Co., Youngstown, O.

SHEETS.
(Deep Drawing Stock.)
American Sheet & Tin Plate Co., Pittsburgh.
Bourne-Fuller Co., Cleveland, O.
Inland Steel Co., Chicago, Ill.
Massillon Rolling Mill Co., Massillon, O.
Youngstown Iron & Steel Co., Youngstown, O.

SHEETS.
(Galvanized.)
Allegheny Steel Co., Pittsburgh, Pa.
American Sheet & Tin Plate Co., Pittsburgh.
Bourne-Fuller Co., Cleveland, O.
Brier Hill Steel Co., Youngstown, O.
Canton Sheet Steel Co., Canton, O.
Inland Steel Co., Chicago, Ill.
La Belle Iron Works, Steubenville, O.
Portsmouth Steel Co., Portsmouth, O.
Republic Iron & Steel Co., Youngstown, O.
Ryerson & Son, Jos. T., Chicago, Ill.
Seneca Iron & Steel Co., Buffalo, N. Y.
Stark Rolling Mill Co., Canton, O.
Trumbull Steel Co., Warren, O.
Western Reserve Steel Co., Warren, O.
Wood, Alan, Iron & Steel Co., Philadelphia.
Youngstown Iron & Steel Co., Youngstown, O.
Youngstown Sh't & Tube Co., Youngstown, O.

See Index to Advertisements for pages containing advertisements of companies listed above

SHEETS.
(Iron and Steel.)
Allegheny Steel Co., Pittsburgh, Pa.
American Rolling Mill Co., Middletown, O.
American Sheet & Tin Plate Co., Pittsburgh.
Bourne-Fuller Co., Cleveland, O.
Brier Hill Steel Co., Youngstown, O.
Canton Sheet Steel Co., Canton, O.
Disston & Sons, Inc., Henry, Philadelphia, Pa.
Illinois Steel Co., Chicago, Ill.
Illinois Steel Co., Warehouse Dept., Chicago, Ill.
Illinois Steel Warehouse Co., St. Louis, Mo.
Illinois Steel Warehouse Co., St. Paul, Minn.
Inland Steel Co., Chicago, Ill.
La Belle Iron Works, Steubenville, O.
Massillon Rolling Mill Co., Massillon, O.
Portsmouth Steel Co., Portsmouth, O.
Republic Iron & Steel Co., Youngstown, O.
Ryerson, Jos. T., & Son, Chicago, Ill.
Scully Steel & Iron Co., Chicago, Ill.
Seneca Iron & Steel Co., Buffalo, N. Y.
Stark Rolling Mill Co., Canton, O.
Tenn. Coal, Iron & R. R. Co., Birmingham, Ala.
Trumbull Steel Co., Warren, O.
Wood, Alan, Iron & Steel Co., Philadelphia, Pa.
Worth Bros. Co., Coatesville, Pa.
Youngstown Sheet & Tube Co., Youngstown, O.

SHEETS.
(Open-Hearth.)
American Sheet & Tin Plate Co., Pittsburgh, Pa.
Bourne-Fuller Co., Cleveland, O.
Brier Hill Steel Co., Youngstown, O.
Canton Sheet Steel Co., Canton, O.
Inland Steel Co., Chicago, Ill.
Portsmouth Steel Co., Portsmouth, O.
Seneca Iron & Steel Co., Buffalo, N. Y.
Stark Rolling Mill Co., Canton, O.
Trumbull Steel Co., Warren, O.
Youngstown Iron & Steel Co., Youngstown, O.

SHEETS.
(Pickled and Cold Rolled.)
American Sheet & Tin Plate Co., Pittsburgh, Pa.
Bourne-Fuller Co., Cleveland, O.
Canton Sheet Steel Co., Canton, O.
Inland Steel Co., Chicago, Ill.
Massillon Rolling Mill Co., Massillon, O.
Western Reserve Steel Co., Warren, O.
Youngstown Sheet & Tube Co., Youngstown, O.

SHEETS.
(Polished.)
American Rolling Mill Co., Middletown, O.
American Sheet & Tin Plate Co., Pittsburgh.
Bourne-Fuller Co., Cleveland, O.
Canton Sheet Steel Co., Canton, O.
Carnahan Tin Plate & Sheet Co., Canton, O.
Massillon Rolling Mill Co., Massillon, O.

SHEETS.
(Roofing.)
Canton Sheet Steel Co., Canton, O.

SHEETS.
(Steel Box Annealed.)
American Sheet & Tin Plate Co., Pittsburgh.
Brier Hill Steel Co., Youngstown, O.
Canton Sheet Steel Co., Canton, O.
Portsmouth Steel Co., Portsmouth, O.
Western Reserve Steel Co., Warren, O.
Youngstown Iron & Steel Co., Youngstown, O.
Youngstown Sheet & Tube Co., Youngstown, O.

SHEET IRON WORK.
Hendrick Mfg. Co., Carbondale, Pa.

SHELVING.
(Steel.)
New Britain Mach. Co., New Britain, Conn.

SHOVELS.
(Steam.)
Thew Automatic Shovel Co., Lorain, O.

SIFTERS.
(Sand.)
Arcade Mfg. Co., Freeport, Ill.
Whiting Fdy. Equipment Co., Harvey, Ill.

SLABS.
Andrews Steel Co., Newport, Ky.
Cambria Steel Co., Johnstown, O.
La Belle Iron Works, Steubenville, O.
Portsmouth Steel Co., Portsmouth O.
Youngstown Sheet & Tube Co., Youngstown, O.

SLABS.
(Sheet.)
Inland Steel Co., Chicago, Ill.
La Belle Iron Works, Steubenville, O.
Lackawanna Steel Co., Buffalo, N. Y.
Tenn. Coal, Iron & R. R. Co., Birmingham, Ala.
Youngstown Sheet & Tube Co., Youngstown, O.

SLEEPERS.
(Creosoted.)
Ayer & Lord Tie Co., Chicago, Ill.
Jennison-Wright Co., The, Toledo, O.

SOLENOIDS.
(Electric.)
Electric Controller & Mfg. Co., Cleveland, O.

SPECIAL STEEL PLATE WORK
Kennicott Co., The, Chicago Heights, Ill.

SPECIALTIES.
(Steam.)
National Tube Co., Pittsburgh, Pa.

SPIEGELEISEN.
Pickands, Brown & Co., Chicago, Ill.

SPIKES.
American Iron & Steel Mfg. Co., Lebanon, Pa.
American Steel & Wire Co., Chicago, Ill.
Inland Steel Co., Chicago, Ill.
Jones & Laughlin Steel Co., Pittsburgh, Pa.
McCance Bros. Co., Verona, Pa.
Republic Iron & Steel Co., Youngstown, O.

SPIKES.
(Screw.)
American Iron & Steel Mfg. Co., Lebanon, Pa.
Illinois Steel Co., Chicago, Ill.

SPLICES.
(Rail.)
Carnegie Steel Co., Pittsburgh, Pa.
Jones & Laughlin Steel Co., Pittsburgh, Pa.
Lackawanna Steel Co., Buffalo, N. Y.
Republic Iron & Steel Co., Youngstown, O.

SPRINGS.
American Steel & Wire Co., Chicago, Ill.

SPRINKLER HEADS.
(Automatic Fire.)
Rockwood Sprinkler Co., Worcester, Mass.

SPRINKLER SYSTEMS.
(Automatic Fire.)
Rockwood Sprinkler Co., Worcester, Mass.

STACKS.
American Bridge Co., New York, N. Y.

STAMPINGS.
(Light.)
Chandler Co., Springfield, Mass.

STAMPINGS.
(Sheet Metal.)
Bettcher Mfg. Co., Cleveland, O.
Rockwood Sprinkler Co., Worcester, Mass.

STAND PIPES.
Kennicott Co., The, Chicago Heights, Ill.

STAPLES.
American Steel & Wire Co., Chicago, Ill.

STARTERS.
(Electric Motor.)
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

STARTERS.
(Electric Motor.) (Manual, Automatic.)
Crocker-Wheeler Co., Ampere, N. J.
Electric Controller & Mfg. Co., Cleveland, O.

STEAM, GAS AND WATER SUPPLIES.
Rockwood Sprinkler Co., Worcester, Mass.

STEEL.
American Bridge Co., New York, N. Y.
Bourne-Fuller Co., Cleveland, O.
Braeburn Steel Co., Pittsburgh, Pa.
Cambria Steel Co., Johnstown, Pa.
Carnegie Steel Co., Pittsburgh, Pa.
Disston & Sons, Inc., Henry, Philadelphia, Pa.
Franklin Steel Works, Franklin, Pa.
Illinois Steel Co., Chicago, Ill.
Illinois Steel Co., Warehouse Dept., Chicago, Ill.
Illinois Steel Warehouse Co., St. Louis Mo.
Illinois Steel Warehouse Co., St. Paul, Minn.
Inland Steel Co., Chicago, Ill.
Jones & Laughlin Steel Co., Pittsburgh, Pa.
La Belle Iron Works, Steubenville, Pa.
Laclede Steel Co., St. Louis, Mo.
Lockhart Iron & Steel Co., McKees Rocks, Pa.
Otis Steel Co., Cleveland, O.
Portsmouth Steel Co., Portsmouth, O.
Republic Iron & Steel Co., Youngstown, O.
Ryerson, Jos. T., & Son, Chicago, Ill.
Tenn. Coal, Iron & R. R. Co., Birmingham, Ala.
Upson Nut Co., Cleveland, O.
West Leechburg Steel Co., Pittsburgh, Pa.
Wood, Alan, Iron & Steel Co., Philadelphia, Pa.
Youngstown Sh't & Tube Co., Youngstown, O.

STEEL.
(Automobile.)
Carbon Steel Co., Pittsburgh, Pa.
United Steel Co., Canton, O.

STEEL.
(Axle, Automobile, Mining Car.)
Union Drawn Steel Co., Beaver Falls, Pa.
United Steel Co., Canton, O.

STEEL.
(Chrome Nickel.)
Crowley Co., Jno. A., New York City.

STEEL.
(Chrome Vanadium.)
Crowley Co., Jno. A., New York City.

STEEL.
(Cold Rolled.)
Bourne-Fuller Co., Cleveland, O.
Pittsburgh Cold Rolled Steel Co., Pittsburgh, Pa.
Scully Steel & Iron Co., Chicago, Ill.

STEEL.
(Cold Drawn.)
Bourne-Fuller Co., Cleveland, O.
Moltrup Steel Products Co., Beaver Falls, Pa.
Standard Gauge Steel Co., Beaver Falls, Pa.
Union Drawn Steel Co., Beaver Falls, Pa.
United Steel Co., Canton, O.

STEEL.
(Electric.)
Crowley Co., Jno. A., New York City.
Illinois Steel Co., Chicago, Ill.

STEEL.
(Forging.)
United Steel Co., Canton, O.

STEEL.
(Gear.)
United Steel Co., Canton, O.

STEEL.
(High Speed.)
Bethlehem Steel Co., South Bethlehem, Pa.
Bourne-Fuller Co., Cleveland, O.
Braeburn Steel Co., Pittsburgh, Pa.
Firth-Sterling Steel Co., McKeesport, Pa.

STEEL.
(Nickel.)
United Steel Co., Canton, O.

STEEL.
(Open-Hearth.)
Bourne-Fuller Co., Cleveland, O.
Brier Hill Steel Co., Youngstown, O.
Cambria Steel Co., Johnstown, Pa.
Illinois Steel Co., Chicago, Ill.
Inland Steel Co., Chicago. Ill.
Portsmouth Steel Co., Portsmouth, O.
Union Drawn Steel Co., Beaver Falls, Pa.
Upson Nut Co., Cleveland, O.

STEEL.
(Rock Drill.)
Firth-Sterling Steel Co., McKeesport, Pa.

STEEL.
(Spring.)
Braeburn Steel Co., Pittsburgh, Pa.
Firth-Sterling Steel Co., McKeesport, Pa.
United Steel Co., Canton, O.

STEEL.
(Structural.)
American Bridge Co., New York, N. Y.
Bethlehem Steel Co., South Bethlehem, Pa.
Bourne-Fuller Co., Cleveland, O.
Cambria Steel Co., Johnstown, Pa.
Carnegie Steel Co., Pittsburgh, Pa.
Cincinnati Iron & Steel Co., Cincinnati, O.
Clinton Bridge Works, Clinton, Ia.
Eichleay, John Jr., Co., Pittsburgh, Pa.
Illinois Steel Co., Chicago, Ill.
Illinois Steel Co., Warehouse Dept., Chicago, Ill.
Illinois Steel Warehouse Co., St. Louis, Mo.
Illinois Steel Warehouse Co., St. Paul, Minn.
Independent Bridge Co., Pittsburgh, Pa.
Inland Steel Co., Chicago, Ill.
Jones & Laughlin Steel Co., Pittsburgh, Pa.
Lackawanna Steel Co., Buffalo, N. Y.
McClintic-Marshall Co., Pittsburgh, Pa.
Portsmouth Steel Co., Portsmouth, O.
Republic Iron & Steel Co., Youngstown, O.
Riter-Conley Mfg. Co., Pittsburgh, Pa.
Ryerson, Joseph T., & Son, Chicago, Ill.

STEEL.
(Tool.)
Bethlehem Steel Co., South Bethlehem, Pa.
Bourne-Fuller Co., Cleveland, O.
Braeburn Steel Co., Pittsburgh, Pa.
Cincinnati Iron & Steel Co., Cincinnati, O.
Firth-Sterling Steel Co., McKeesport, Pa.
Ryerson, Joseph T., & Son, Chicago, Ill.

STEEL.
(Twisted.)
Bourne-Fuller Co., Cleveland, O.
Cincinnati Iron & Steel Co., Cincinnati, O.
Franklin Steel Works, Franklin, Pa.
Upson Nut Co., Cleveland, O.

STEEL.
(Vanadium.)
Bourne-Fuller Co., Cleveland O.
Carnegie Steel Co., Pittsburgh, Pa.
United Steel Co., Canton, O.

STEEL STACKS.
Kennicott Co., The, Chicago Heights, Ill.

STEEL UNDERFRAMES.
Kennicott Co., The, Chicago Heights, Ill.

STOCKS.
Kennicott Co., The, Chicago Heights, Ill.
Mark Mfg. Co., Evanston, Ill.

STOKERS.
Erie Foundry Co., Erie, Pa.
Green Engineering Co., Chicago, Ill.

STOPS.
(Electric Limit.)
(For Cranes, etc.)
Electric Controller & Mfg. Co., Cleveland, O.

STRUCTURAL TIMBERS.
(Creosoted.)
Ayer & Lord Tie Co., Chicago, Ill.
Jennison-Wright Co., The, Toledo, O.

STUDDING.
(Metal.)
Youngstown Iron & Steel Co., Youngstown, O.

SULPHATE OF IRON.
American Steel & Wire Co., Chicago, Ill.

SUPPLIES.
(Well.)
Mark Mfg. Co., Evanston, Ill.
National Tube Co., Pittsburgh, Pa.

SURFACE GRINDING MACHINE.
Norton Grinding Co., Worcester, Mass.

SWITCH BOARDS.
(For Cranes.)
Electric Controller & Mfg. Co., Cleveland, O.

SWITCHES.
(Automatic Float, Knife, Snap.)
Electric Controller & Mfg. Co., Cleveland, O.

See Index to Advertisements for pages containing advertisements of companies listed above

SWITCHES.
(Electrical.)
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

SWITCHES.
(Magnetic.)
Electric Controller & Mfg. Co., Cleveland, O.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

TABLES.
(Drawing.)
Economy Drawing Table Co., Toledo, O.

TABLES.
(Rolling Mill.)
Mackintosh, Hemphill & Co., Pittsburgh, Pa.
Morgan Construction Co., Worcester, Mass.
Tod Co., Wm., Youngstown, O.
United Engrg. & Fdy. Co., Pittsburgh, Pa.

TABLES.
(Transfer.)
Industrial Works, Bay City, Mich.

TACKS.
American Steel & Wire Co., Chicago, Ill.

TANKS AND BOILERS.
New York Central Iron Wks. Co., Hagerstown, Md.

TANKS AND TOWERS.
Acme Boiler Works, Canal Dover, O.
American Bridge Co., New York, N. Y.
Kennicott Co., The, Chicago Heights, Ill.
National Tube Co., Pittsburgh, Pa.
Riter-Conley Mfg. Co., Pittsburgh, Pa.

TANKS.
(Car, Grain.)
Kennicott Co., The, Chicago Heights, Ill.

TANKS.
(Water and Acid Storage, Wire Mills.)
Kennicott Co., The, Chicago Heights, Ill.
Morgan Construction Co., Worcester, Mass.
New York Central Iron Wks. Co., Hagerstown, Md.
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

TANK CARS.
Kennicott Co., The, Chicago Heights, Ill.

TEETH.
(Steel Harrow.)
Inland Steel Co., Chicago, Ill.

THERMOMETERS.
Bristol Co., Waterbury, Conn.
Brown Instrument Co., Philadelphia, Pa.

TIES.
(Creosoted.)
Ayer & Lord Tie Co., Chicago, Ill.
Jennison-Wright Co., The, Toledo, O.

TILE.
(Fire Clay, Furnace, Hollow, Etc.)
Union Mining Co., Mt. Savage, Md.

TIN PLATE.
American Sheet & Tin Plate Co., Pittsburgh, Pa.
Carnahan Tin Plate & Sheet Co., Canton, O.
Jones & Laughlin Steel Co., Pittsburgh, Pa.
Standard Tin Plate Co., Canonsburg, Pa.
Taylor, N. & G., Co., Philadelphia, Pa.

TITANIUM.
Titanium Alloy Mfg. Co., Niagara Falls, N. Y.

TOOLS.
(Machinists.)
Morse Twist Drill & Mach. Co., New Bedford, Mass.

TOOLS.
(Pneumatic.)
Cleveland Pneumatic Tool Co., Cleveland, O.
Ryerson, Jos. T., & Son, Chicago, Ill.

TOOLS.
(Thread Cutting.)
Landis Machine Co., Waynesboro, Pa.

TRACK.
(Industrial.)
Atlas Car & Mfg. Co., Cleveland, O.
Chase Foundry & Mfg. Co., Columbus, O.

TRAMRAILS.
(Overhead Systems.)
Brown Hoisting Machinery Co., Cleveland, O.
Northern Engrg. Works, Detroit, Mich.
Whiting Foundry Equipment Co, Harvey, Ill.

TRAMWAYS.
American Steel & Wire Co., Chicago, Ill.

TRAPS.
(Steam.)
National Tube Co., Pittsburgh, Pa.

TROLLEYS.
Brown Hoisting Machinery Co., Cleveland, O.
Browning Engineering Co., Cleveland, O.
Chisholm & Moore Mfg. Co., Cleveland, O.
Whiting Foundry Equipment Co., Harvey, Ill.

TRUCKS.
(Foundry.)
Sterling Wheelbarrow Co., Milwaukee, Wis.
Whiting Foundry Equipment Co., Harvey, Ill.

TRUCKS.
(Motors.)
Kissell Motor Car Co., Hartford, Wis.

TRUCKS.
(Wire, Rod, Wire Mills.)
Morgan Construction Co., Worcester, Mass.
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

TUBES.
Mark Mfg. Co., Evanston, Ill.
National Tube Co., Pittsburgh, Pa.
Republic Iron & Steel Co., Youngstown, O.
Youngstown Sh't & Tube Co., Youngstown, O.

TUBES.
(Boiler.)
Allegheny Steel Co., Pittsburgh, Pa.
Bourne-Fuller Co., Cleveland, O.
National Tube Co., Pittsburg, Pa.
Newport Rolling Mill Co., Newport, Ky.
Ryerson, Joseph T., & Son, Chicago, Ill.
Scully Steel & Iron Co., Chicago, Ill.
Worth Bros Co., Coatesville, Pa.

TUBING.
(Automobile.)
National Tube Co., Pittsburgh, Pa.

TUBING.
(Oil Well.)
National Tube Co., Pittsburgh, Pa.
Youngstown Sh't & Tube Co., Youngstown, O.

TUBING.
(Seamless Steel.)
National Tube Co., Pittsburgh, Pa.

TUMBLING MILLS.
Northern Engineering Works, Detroit, Mich.
Whiting Fdy. Equipment Co., Harvey, Ill.

TURBINES.
(Steam.)
General Electric Co., Schenectady, N. Y.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

TURNBUCKLES.
American Bridge Co., New York, N. Y.
American Iron & Steel Mfg. Co., Lebanon, Pa.
Bourne-Fuller Co., Cleveland, O.
Michigan Bolt & Nut Works, Detroit, Mich.
Milton Mfg. Co., Milton, Pa.
Republic Iron & Steel Co., Youngstown, O.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.

TURNTABLES.
American Bridge Co., New York, N. Y.
Atlas Car & Mfg. Co., Cleveland, O.
Chase Foundry & Mfg. Co., Columbus, O.
Whiting Foundry Equipment, Co., Harvey, Ill.

UNDER FLOORING.
(Creosoted.)
Ayer & Lord Tie Co., Chicago, Ill.
Jennison-Wright Co., The, Toledo, O.

UNIONS.
(Pipe.)
Best Mfg. Co., Pittsburgh, Pa.
Dart, E. M., Mfg. Co., Providence, R. I.
Illinois Malleable Iron Co., Chicago, Ill.
Mark Mfg. Co., Evanston, Ill.
National Tube Co., Pittsburgh, Pa.
Rockwood Sprinkler Co., Worcester, Mass.

UNIVERSAL TOOL AND CUTTER.
Norton Grinding Co., Worcester, Mass.

VALVE LEATHERS.
Graton & Knight Mfg. Co., Worcester, Mass.

VALVES.
Best Mfg. Co., Pittsburgh, Pa.
Mackintosh, Hemphill & Co., Pittsburgh, Pa.
National Tube Co., Pittsburgh, Pa.
Pittsburgh Piping & Equipment Co., Pittsburgh, Pa.
Pittsburgh Valve, Fdy. & Construction Co., Pittsburgh, Pa.
Scully Steel & Iron Co., Chicago, Ill.

VALVES.
(Gas and Air Reversing.)
Morgan Construction Co., Worcester, Mass.

VALVES AND FITTINGS.
(Hydraulic.)
Chambersburg Engrg. Co., Chambersburg, Pa.
Hydraulic Press Mfg. Co., Mt. Gilead, O.
Mackintosh, Hemphill & Co., Pittsburgh, Pa.
National Tube Co., Pittsburgh, Pa.
Watson-Stillman Co., New York, N. Y.

VISES.
Mark Mfg. Co., Evanston, Ill.

WAGON HARDWARE.
Oliver Iron & Steel Co., Pittsburgh, Pa.

WASHERS.
American Iron & Steel Mfg. Co., Lebanon, Pa.
Bettcher Mfg. Co., Cleveland, O.
Bourne-Fuller Co., Cleveland, O.
Milton Mfg. Co., Milton, Pa.
Oliver Iron & Steel Co., Pittsburgh, Pa.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Upson Nut Co., Cleveland, O.
Wrought Washer Mfg. Co., Milwaukee, Wis.

WASHERS.
(Leather.)
Graton & Knight Mfg. Co., The, Worcester, Mass.

WATER SOFTENERS AND PURIFIERS.
Kennicott Co., The, Chicago Heights, Ill.

WEIGHERS.
(Feed Water.)
Kennicott Co., The, Chicago Heights, Ill.

WELDERS.
(Electric.)
Long & Allstatter Co., Hamilton, O.
Thomson Elec. Welding Co., Lynn, Mass.
Toledo Electric Welder Co., Cincinnati, O.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

WELDING.
(Custom.)
Oxweld Acetylene Co., Chicago, Ill.
Racine Drop Forge Co., Racine, Wis.
Thomson Electric Welding Co., Lynn, Mass.

WELDING.
(Oxy-Acetylene Process.)
Linde Air Products Co., New York, N. Y.
Oxweld Acetylene Co., Chicago, Ill.

WHEELBARROWS.
Sterling Wheelbarrow Co., Milwaukee, Wis.

WHEELS.
(Rope.)
Cooper, C. & G., Co., Mt. Vernon, O.
Mesta Machine Co., Pittsburgh, Pa.

WHEELS.
(Steel Car.)
American Steel Foundries, Chicago, Ill.
Carnegie Steel Co., Pittsburgh, Pa.

WIRE.
American Steel & Wire Co., Chicago, Ill.
Cambria Steel Co., Johnstown, Pa.
Jones & Laughlin Steel Co., Pittsburgh, Pa.
Youngstown Sh't & Tube Co., Youngstown, O.

WIRE.
(Barbed.)
American Steel & Wire Co., Chicago, Ill.
Youngstown Sh't & Tube Co., Youngstown, O.

WIRE.
(Broom.)
American Steel & Wire Co., Chicago, Ill.

WIRE.
(Enameled Magnet.)
American Steel & Wire Co., Chicago, Ill.

WIRE.
(Fence.)
American Steel & Wire Co., Chicago, Ill.

WIRE.
(Mattress.)
American Steel & Wire Co., Chicago, Ill.

WIRE.
(Piano.)
American Steel & Wire Co., Chicago, Ill.

WIRE.
(Pipe Organ.)
American Steel & Wire Co., Chicago, Ill.

WIRE.
(Rubber Covered.)
American Steel & Wire Co., Chicago, Ill.

WIRE.
(Spoke for Wire Wheels.)
American Steel & Wire Co., Chicago, Ill.

WIRE.
(Telephone and Telegraph.)
American Steel & Wire Co., Chicago, Ill.

WIRE.
(Threaded.)
Progressive Mfg. Co., Torrington, Conn.

WIRE.
(Weaving.)
American Steel & Wire Co., Chicago, Ill.

WIRE HOOPS.
American Steel & Wire Co., Chicago, Ill.

WIRE MILLS.
(Complete Equipment.)
Morgan Construction Co., Worcester, Mass.
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

WIRE ROPE.
American Steel & Wire Co., Chicago, Ill.

WIRE ROPE.
(Elevator.)
American Steel & Wire Co., Chicago, Ill.

WIRE ROPE FITTINGS.
American Steel & Wire Co., Chicago, Ill.

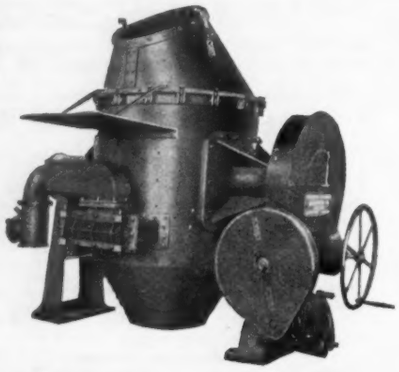
WOOD BLOCKS.
(Creosoted.)
Ayer & Lord Tie Co., Chicago, Ill.
Jennison-Wright Co., The, Toledo, O.

WRENCHES.
Ryerson, Jos. T., & Son, Chicago, Ill.
Trimont Mfg. Co., Boston, Mass.

WRENCH.
(Chain.)
Drop Forg'g Co. of N. Y., Jersey City, N. J.
Trimont Mfg. Co., Boston, Mass.

WRENCHES.
(Pipe.)
Drop Forg'g Co. of N. Y., Jersey City, N. J.
Trimont Mfg. Co., Boston, Mass.

See Index to Advertisements for pages containing advertisements of companies listed above



The WHITING CONVERTER

enables any foundry to make its own steel castings of whatever grade or analysis desired.

A uniform product, reduced pattern expense and castings when wanted are only some of the big advantages gained.

Write today for Catalog No. 106

Complete Foundry Plants

WHITING FOUNDRY EQUIPMENT CO. HARVEY-ILL. U.S.A.

Cranes of All Kinds

The MORGAN ENGINEERING COMPANY

ESTABLISHED 1868

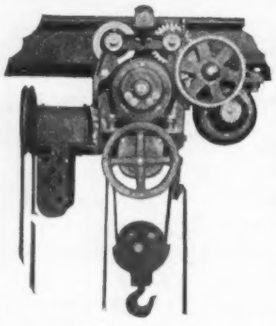
Alliance, Ohio. U.S.A.

CRANES, CHARGING MACHINES, SHEARS, STEAM HAMMERS. All Kinds of Heavy Machinery.

PNEUMATIC GEARED HOISTS 1 to 15 Tons

MOTORS 2 TO 20 H. P. FOR Cranes Derricks Winches

Detroit Hoist & Machine Co.
DETROIT, MICH.



CRANES HOISTS

Electric and Hand Power Traveling Cranes, Jib and Post Cranes, Electric Hoists, floor and cab operated. Overhead Trolley Systems and Trolleys.

The Euclid Crane & Hoist Co.
EUCLID, OHIO

NORTHERN CRANES

ELECTRIC and HAND TRAVELING CRANES
ELECTRIC and AIR HOISTS and TROLLIES

NORTHERN ENGINEERING WORKS.
DETROIT, MICH. U.S.A.

(Canadian works—Northern Crane Wks., Ltd., Walkerville, Ont.)

"P & H" CRANES and HOISTS

are being used to handle every conceivable kind of material.

PAWLING & HARNISCHFEGER CO., Milwaukee, Wis.

"THEW" AUTOMATIC Shovels Show Economy for Underground Mining and Stripping

THEW AUTOMATIC SHOVEL CO.
LORAIN, O.

NILES CRANES

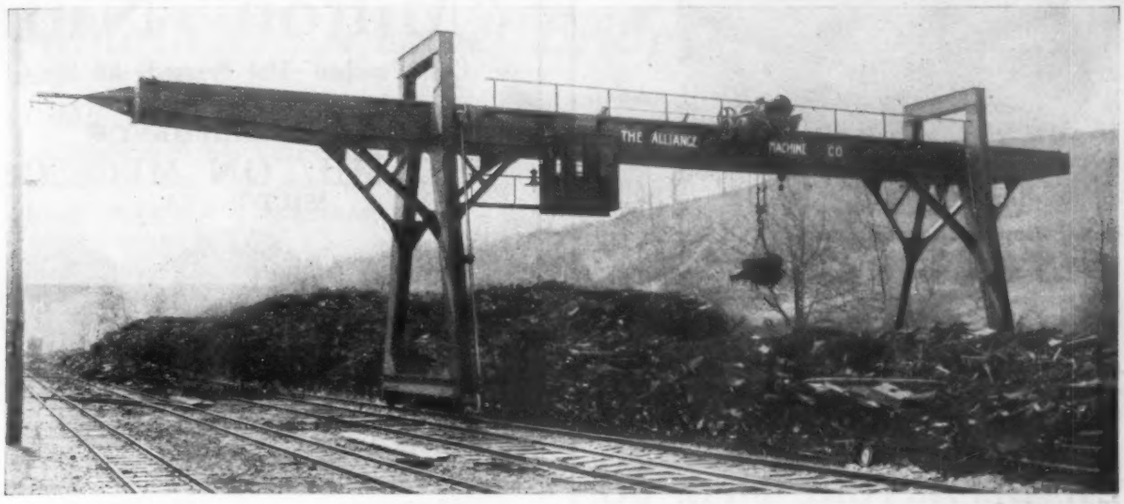
For Machine Shops, Foundries, Railway Repair Shops, Shipyards, Lumber and Stone Yards

Write for Catalogue "Niles Cranes"

NILES-BEMENT-POND CO., 111 Broadway, New York

Boston Philadelphia Pittsburgh Chicago St. Louis Birmingham

"ALLIANCE" Double Cantilever Gantry Crane---Magnet Type



Taken at Worth Bros. Co.

PICTURE shows our standard construction of magnet cantilever gantry crane. This type of crane is specially adapted for service in the stock yards of steel plants, and other installations where it is desirable to have a storage space in the middle and railroad tracks under the cantilevers. The machine is built in any span and capacity, and for any service.

A dependable gantry crane equipped with either a magnet or grab bucket is the most economical method of handling material.

PITTSBURG *The Largest Manufacturers of the Worlds Largest Cranes* NEW YORK

THE ALLIANCE MACHINE CO.
ALLIANCE, OHIO.
BIRMINGHAM **ENGINEERS AND BUILDERS** CHICAGO

"SAFETY FIRST"!

The elements of SAFETY are inherent in the rugged design and construction of

SHAW CRANES

Send for Bulletins describing Shaw Type Z Motors, Type S Controllers, Type B Safety Hoist Limit and other salient features.

MANNING, MAXWELL & MOORE, Inc., Shaw Electric Crane Co., Dept.

GENERAL OFFICES: 119 WEST 40th STREET, NEW YORK CITY

BRANCH OFFICES:

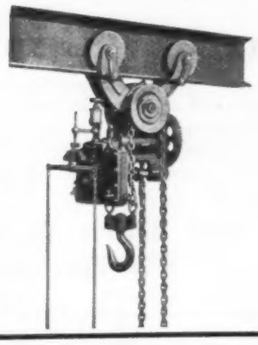
Chicago, Ill.	Detroit, Mich.	Milwaukee, Wis.	Pittsburgh, Pa.
Cincinnati, Ohio	Boston, Mass.	New Haven, Conn.	St. Louis, Mo.
Cleveland, Ohio	Buffalo, N. Y.	Philadelphia, Pa.	San Francisco, Cal.

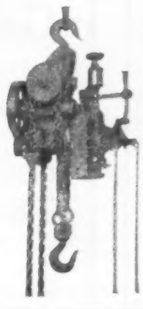
The Dake Pneumatic Geared Hoists and Motors

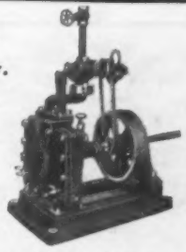
Can furnish hoists with either chain or wire rope. Sizes ½ to 10 tons capacity.

Write for catalog and prices.

Reversing Steam or Air Motor ½ to 30 hp.







Stationary Engine (2 to 30 hp).

Also manufacturers of
Hoisting Engines
Swinging Engines
Motor Crabs
Drill Hoists
Spud Hoists
Marine Machinery, Etc.

Grey Iron, Brass, Bronze and Aluminum Castings of every description

Dake Engine Co.
Grand Haven, Mich.

Roller Bearing Cars and Trucks of all kinds for all purposes, Switches, Turntables and Complete Industrial Railway Equipments.

Write us for Catalog and Prices

THE CHASE FOUNDRY & MFG. CO.
Columbus, Ohio

"Milton" Nuts

Cold Punched—Hot Pressed—All Styles

LARGE ASSORTMENT OF SIZES. PROMPT SHIPMENTS

THE MILTON MFG. CO.
MILTON, PA.

Important Notice

The General Offices of the

NEW DEPARTURE MFG. CO.

are now located at

BRISTOL, CONN.

"GUARANTEED BALL BEARINGS"

U. S. METAL and MANUFACTURING COMPANY

NEW YORK CHICAGO PITTSBURGH
LEBANON, PA. PROVIDENCE, R. I.

Railroad Supplies **Scrap Iron**

We invite your inquiries

Gears of All Descriptions

to 24 feet diameter, including cut herringbone gears with teeth cut from solid blanks.

Heavy Machinery Designed and Furnished for All Purposes

FAWCUS MACHINE CO.

Works: Ford City and Pittsburgh, Pa.
Main Office: Pittsburgh, Pa.

DIXON'S SOLID BELT DRESSING

Send for "The Proper Care of Belts," No. 64

Made in JERSEY CITY, N. J. by the

Joseph Dixon Crucible Company

No Vibration! *No Hammering!* *No Backlash!*

WUEST HERRINGBONE GEARS

Stand for *"Mechanical Efficiency."*

Strongly in contrast with the intermittent action of *spur* gears, all *Wuest* gears are guaranteed to have *continuous* action.

Consult us—our Engineers will be glad to give you the benefit of their ideas, free.

THE FALK COMPANY **Milwaukee, Wisconsin**

SPARTAN GUARANTEED BELTING

Absolutely Steamproof

Guaranteed to withstand exposure to hot or cold air, water, steam, oil, acid fumes and heat generated by excessive pulley friction.

Send for further particulars and Spartan Book.

THE GRATON & KNIGHT MFG. CO.
Worcester, Mass., U. S. A.

BEVEL GEAR GENERATORS

BEVEL GEARS

Cut **theoretically** correct

Special facilities for cutting Worm, Spiral, Mitre Internal and Elliptical Gear Wheels

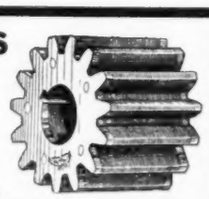
THE BILGRAM MACHINE WORKS
1233 Spring Garden St., Philadelphia, Pa.

NOISELESS PINIONS

for motor and other high speed drives.

See our large advertisement in first and third issues of the month.

New Process Gear Corporation
400 Plum Street Syracuse, New York



THE SILENT RUNNING

PEERLESS RAWHIDE PINIONS

Accurate - Efficient - Durable

Are being used today with great success in many of the largest shops.

We also manufacture all styles and sizes of METAL GEARS.

Write us

THE HORSBURGH & SCOTT CO.
5114 Hamilton Ave. N. E., CLEVELAND, OHIO

Gears and Gear Cutting

We manufacture complete, machine complete, or cut only Gears and Pinions of every description.

Gearing is our specialty. A competent force of engineers always at your service. Send on your specifications.

V. D. & D. Gears and Pinions have established a reputation for accuracy and dependability.

The Van Dorn & Dutton Co.

Gear Specialists

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Building Cleveland's Mammoth High Level Bridge

When big construction jobs are undertaken you must have dependable equipment. The Great Lakes Dredge & Dock Company is one of those successful firms who are careful buyers, and when they started work on this immense construction job, one of the ***first*** things they did was to place two

"McMyler Interstate Cranes"

on the site and since that time these machines have been busy every minute, dredging, handling concrete piles, placing concrete, lifting forms and doing other miscellaneous work.

"THEY'LL DO AS MUCH FOR YOU"

Write for bulletins.

The McMyler Interstate Co.

CLEVELAND, O.

BRANCH OFFICES:

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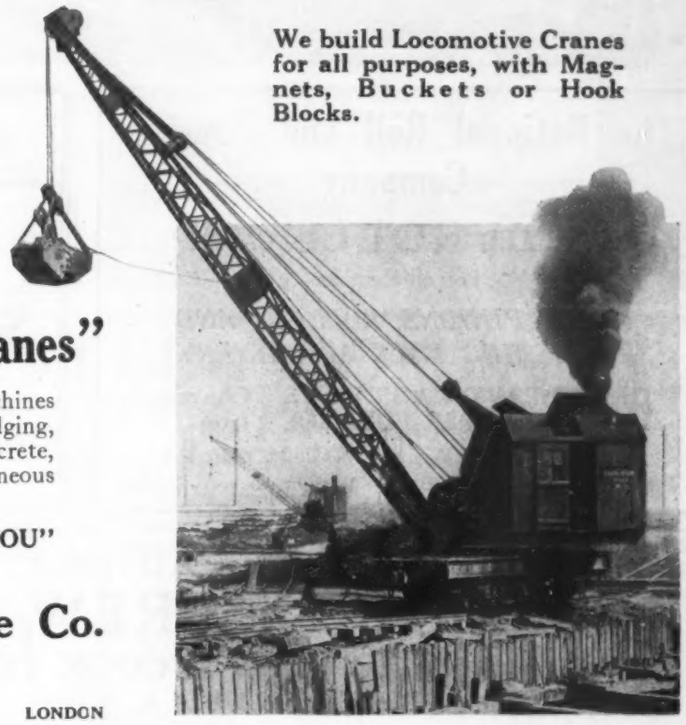


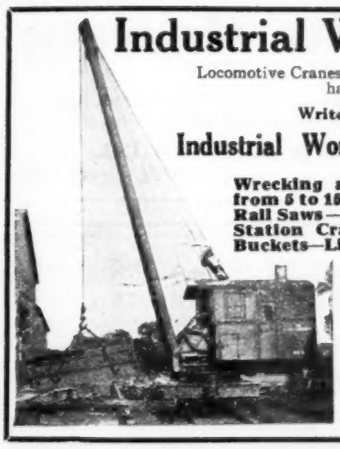
We build Locomotive Cranes for all purposes, with Magnets, Buckets or Hook Blocks.

Industrial Works

Locomotive Cranes increase profits by decreasing handling costs.

Write for a Catalog.

Industrial Works, Bay City, Mich.



Wrecking and Locomotive Cranes—from 5 to 150 tons Capacity—Portable Rail Saws—Transfer Tables—Freight Station Cranes—Pile Drivers—Grab Buckets—Lifting Magnets.

SALES AGENCIES—GEORGE M. NEWHALL ENGINEERING CO., Philadelphia, 50 Church St., New York and Pittsburgh. J. G. MILLER, St. Louis. C. B. DAVIS ENGINEERING CO., Birmingham. F. H. HOPKINS & CO., Montreal.

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COAL HANDLING EQUIPMENT

HOISTING MACHINERY
STEAM AND ELECTRIC HOISTS
ELECTRIC TRANSPORTERS

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San Francisco Pittsburgh Vancouver Montreal

CUTTING COSTS!

This is a problem which confronts you right now and here is the solution. It is a known fact the

O. S. Locomotive CRANES

are today doing more for American manufacturers in assisting to reduce the cost of their production than any other labor saving machinery yet invented. Consult us on your material handling problems.

Orton & Steinbrenner Co.

Chicago, Ill.

Shops: Huntington, Indiana

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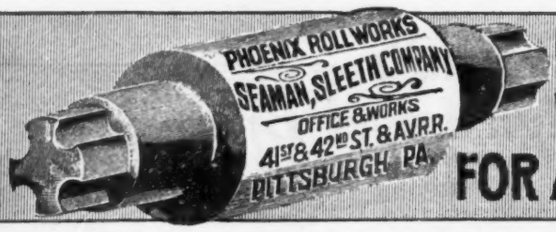
ROLLS



ESTABLISHED 1870
EXCLUSIVELY
FOR ALL PURPOSES.

The National Roll and Foundry Company

SAND CHILLED **ROLLS** CAST STEEL
For all Purposes

MILL PINIONS, ROLLING AND FINISHING MILL MACHINERY

Grey Iron } HEAVY CASTINGS { Charcoal Iron
FROM AIR FURNACE

Main Office and Works, AVONMORE, PA.
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Rolling Mill Machinery

We will be glad to build anything you may require according to your designs or ours. Grey Iron, Charcoal Iron and Air Furnace Castings up to 15 tons.

Sand—ROLLS—Chilled

One plant devoted exclusively to the Manufacture of Rolls.

THE YOUNGSTOWN FDY. & MACH. CO.
YOUNGSTOWN, O.

AUTOMATIC
WOOD SCREW MACHINES
ASA S. COOK COMPANY
Cable Address: Cook, Hartford, U. S. A. HARTFORD, CONN.

A. GARRISON FOUNDRY CO.
Forging Machinery
Chilled Rolls
Rolling Mill Machinery
Special Machinery
Presses
Shears
Straighteners
Accumulators
Established 1803
BINGHAM ST, PITTSBURGH.

Cold Rolling Machinery
FOR FLAT WIRE
With extreme accuracy our improved machines produce the maximum in flat wire of all practical sizes.
THE BLAKE & JOHNSON CO.
WATERBURY CONN. (Since 1849)

WE are specializing on **Automobile Sheets** for body and fender work. **Polished Blue Sheets** for range and stove manufacturers. **Full Finished Sheets** of all description.
The Massillon Rolling Mill Co., Massillon, Ohio

John Eichleay Jr. Co.
Riveted Steel Structures
PITTSBURGH, PA.

Standard Tin Plate Company
CANONSBURG, PA.
Tin Plates, Black Plates, Terne Plates
ALL GRADES, COATINGS AND FINISHES
Our recent increased capacity for Common Terne and Black Plates solicits further patronage
Also Tin Plates of Our Usual Good Quality

CUMBERLAND STEEL COMPANY
TURNED AND GROUND CUMBERLAND, MD.
HIGHLY POLISHED SHAFTING U.S.A.

Only Makers of "CUMBERLAND GROUND" Shafting
Large Stocks. Quick Shipments.

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This screen does the final cleaning of coal better than any other device known.

Write for Circular 21.

Our Patent Flanged Lip Screen.

PERFORATED METALS

OF EVERY DESCRIPTION

Elevator Buckets, Stacks and Tanks

HENDRICK MFG. CO.

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New York Office: 30 Church St.

TRUMBULL STEEL CO.

DIVERSIFIED SHEET AND TIN MILL PRODUCTS

TRUMBULL ROOFING AND SIDING

All styles manufactured from our own Sheet and Tin Mill Products.

Corrugated	Open Hearth Terne
V Crimped	Roofing Tin in Rolls
Pressed Standing Seam	Metal Shingles
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Ridge Roll, all styles	Steel Siding

Other extensively manufactured products include Black and Galvanized Flat Sheets—Bright Coke and Charcoal Tin Plate.

THIS BRAND SIGNIFIES QUALITY

WARREN, OHIO.

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Sole Producers "PITTSBURGH PURE" Brand AMERICAN INGOT IRON and "ALLEGHENY IRON"—Sheets Plates Boiler Tubes

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FJAB DRILL STEEL

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GRADE 6.

OIL HARDENING
NON SHRINKING
NON WARPING

TOOL STEEL

For Taps, Dies, Reamers, etc.

BRAEBURN STEEL CO.

"The Tool Steel Mill"

• BRAEBURN, PA.

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PITTSBURGH—NEW YORK—PHILADELPHIA—BOSTON—POTTSTOWN, PA.—COLUMBUS—DETROIT—CHICAGO—ST. LOUIS—SAN FRANCISCO

WORKS—PITTSBURGH, POTTSTOWN AND CARNEGIE, PA.

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LARGEST INDEPENDENT MANUFACTURERS AND ERECTORS

THE CANTON SHEET STEEL CO. WINIR BLACK & GALVANIZED STEEL SHEETS TRADE MARK CANTON, OHIO

Galvanized Sheets Black Sheets

Especially adapted for Manufacturers' Requirements.

We Manufacture Flat Sheets from Open Hearth Bars of our Own Analysis and as we control the Quality of our Raw Material Supply, we Absolutely Safeguard a High Standard in the Finished Product.

ROOFING Painted and Galvanized

Carload Business our Specialty

We Sell the Jobber

Prompt Shipments—Let Us Quote

In Considering the Product Consider the Plant

There's a scientific explanation for the QUALITY of all WEST LEECHBURG products—

Basic Open Hearth Metal—rolled into deep drawing strip steels of ductility, endurance and strength.

From carefully selected materials, these are produced in one self contained plant.

Open Hearth Furnaces—Hot Finishing Mills—Cold Rolling Mills—Pickling and Annealing Departments, with all of the auxiliary equipment necessary to produce HIGH GRADE Steels, backed by an Organization specializing in the Processes that give to the Drawing—Forming—Stamping—Tube and Moulding Industries materials eminently fitted to meet the most trying conditions.

West Leechburg Steel Company

Farmers Bank Building Pittsburgh, Pa.

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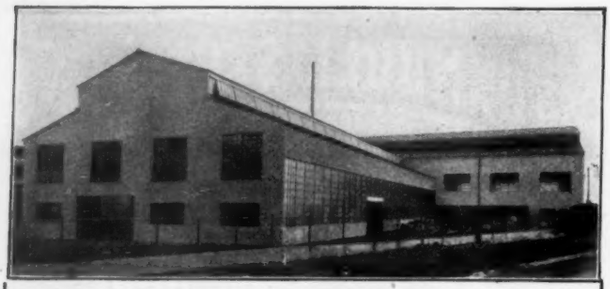


MARK MFG. CO., EVANSTON, ILL.
Hy-Rib Concrete Sidings and United Steel Sash used in windows.

Now is the Time to Build Good Factories Cheap

Building today is much lower in cost than for years back, much lower than it will be later on. Building materials are cheap—labor is plentiful—contractors eliminating profits to hold their organization together. Next spring you will need more space to take care of increased business.

Build modern, permanent, fireproof, daylight factories. If it's one story high, use ***Hy-Rib Concrete Roofs and Sidings;*** if higher, use the ***Kahn System Reinforced Concrete.*** In either case have plenty of daylight by using large windows of ***United Steel Sash.***

Hy-Rib Concrete Roofs are built without forms, are light in weight, saving in structural supports, are economical in cost and quickly erected.

Hy-Rib Concrete Sidings are monolithic and permanent, yet cost only one-half of brick, only two inches thick adding fully a foot to the interior, clean cut in appearance and very economical.

Kahn System Reinforced Concrete is furnished in all type of designs and includes all forms of reinforcement—Used in thousands of important structures—Very economical and efficient—Absolutely fireproof and permanent—Backed by a corps of concrete specialists of unequalled experience ready to co-operate with you, your architects and your engineers.

United Steel Sash are of unequalled strength and durability, assure maximum daylight and absolute weatherproofness—equipped with special hardware of our own manufacture—Furnished in all sizes and all types of sliding and pivoted sash, continuous sash, partitions, doors and casements. Individually designed to exactly meet your requirements and to give permanent satisfaction and service.

If you are considering building, write us. Our suggestions and literature are FREE—our service is prompt and efficient.

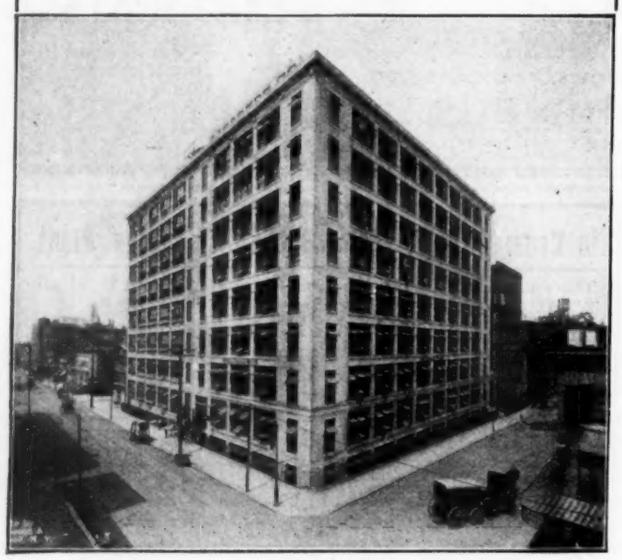
Trussed Concrete Steel Co.

Department G-31
Youngstown, Ohio

KAHN Building Products
TRUSSED CONCRETE STEEL CO

Reinforcement, Metal Lath, Steel Sash, Armor Plates, Waterproofings, Specialties

REPRESENTATIVES IN PRINCIPAL CITIES



MERGENTHALER LINOTYPE CO., BROOKLYN, N. Y.
Kahn System Reinforced Concrete and United Steel Sash used in w ndows.

TURBINE PIPING

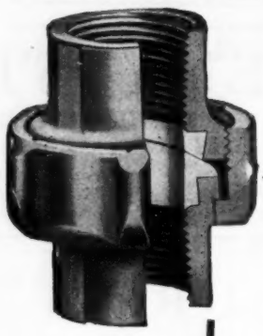
Main steam header and leads to turbines in Power House of a Blast Furnace Plant, using steel valves and fittings and Pittsburgh joint flanges, for superheated steam.

Entire piping equipment furnished and installed by us.

Pittsburgh Piping & Equipment Co.

Piping Engineers and Contractors

Pittsburgh Cleveland Boston Chicago Denver Birmingham San Francisco



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Here is the ONLY *Pressed Steel Union* having *two bronze seats.* These seats are ground to a ball joint, which is

Insurance Against Leakage!

Guaranteed to hold tight under all fluid pressures up to one thousand pounds on the square inch.

The "*Rockwood*" is sherardized after threading, thus becoming rustproof.

Write us today for full details.

The "Rockwood" will eliminate your troubles and give you *Union Efficiency!*

Rockwood Sprinkler Co. of Mass.
Worcester, Mass.

DART UNIONS

BRONZE TO BRONZE

See Dec. 3rd and Jan. 7th, issues of The Iron Trade Review.

Ask your dealer for prices

E. M. Dart Manufacturing Co.
PROVIDENCE, R. I.
The Fairbanks Co., Sales Agents
Canadian Factory: Dart Union Co., Ltd., Toronto

NOKOROS

The only Union made
Absolutely Non-Corrosive
At all contact points
Air Tested and GUARANTEED Tight

Made of Air Furnace Malleable Iron an Best Steam Metal

ILLINOIS MALLEABLE IRON CO.
CHICAGO, ILLINOIS

Manufacturers of a Complete Line of
MALLEABLE AND CAST IRON FITTINGS
Write for Catalogue

OXYHYDROGEN

QUINTESSENCE OF PURITY

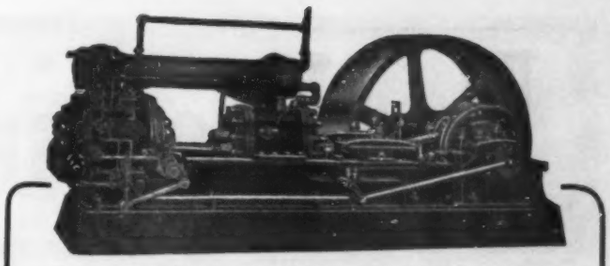
as made by the

I.O.C. SYSTEM

Will perform from 20 to 30% more work than ordinary oxygen. The I. O. C. System Oxygen and Hydrogen Generators offer the cheapest method of producing these gases whenever and wherever required.
Automatic, safe, simple and free from upkeep expense.
References on application.

International Oxygen Company

Works: Newark, N. J. Pittsburgh, Pa., Park Bldg.
General Sales Office, 115 Broadway, NEW YORK
Paris, France, 40 Rue Laffitte



Automatic Selective Proportional Unloaders are found exclusively on the

NORWALK COMPRESSOR

These improvements mark a new era in compressor construction. They gain the instant and favorable attention of all skilled engineers.
For the usual hackneyed claims of ECONOMY, DURABILITY and EFFICIENCY, let our forty years' experience be an assurance of adequate and discerning attention to every feature.

The Norwalk Iron Works Co., South Norwalk, Conn.

RAPID SCRAP CUTTING

The Quickest, Easiest Way

The Oxweld Cutting Blowpipe accomplishes swiftly and without trouble, jobs of cutting that could not possibly be done by any other method. Just notice how frequently it is used for wrecking large buildings of steel construction.

Let us send you full details.

OXWELD ACETYLENE COMPANY
Newark, N. J. Chicago Los Angeles

ELECTRIC WELDING

JOB WELDING

THOMSON
Electric Welders
The Pioneer Manufacturers
BUTT WELDERS
A Specialty
CATALOGUE C

Thomson Electric Welding Co. Lynn, Mass.

Valves and Fittings

ATWOOD

of all sizes for all purposes.

Complete Piping Systems.

Pittsburgh Valve Foundry & Construction Co.
Pittsburgh, Pa.

R. D. Wood & Co.

Guillotine Plate Shears, Forging Presses, Punches, Riveters and General Steel Working Tools. Accumulators, Pressure Pumps, Steam and Centrifugal Pumps, Gas Holders, Gas Power Plants with Producers. :: :: ::

400 Chestnut St. Philadelphia, Pa.

PERFECT DESIGN AND WORKMANSHIP
ONE FEATURE OF

THE PROVIDENCE PUMP

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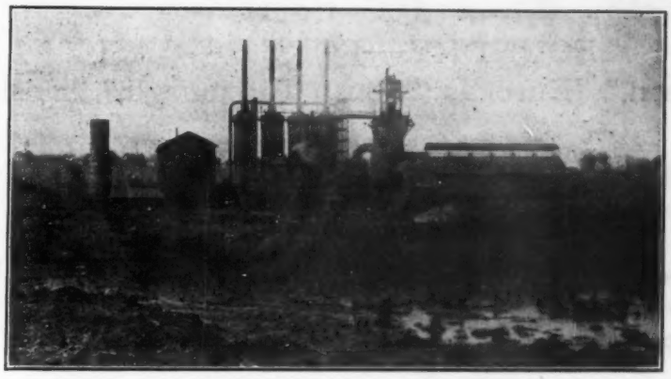

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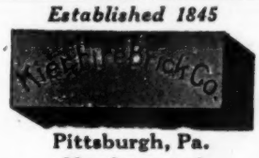
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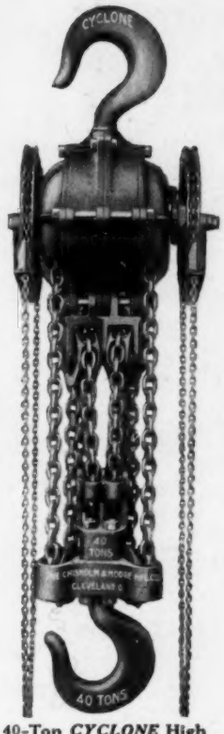

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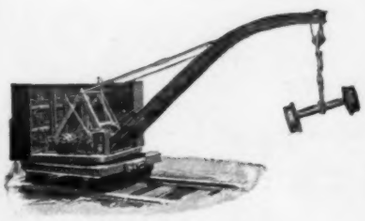

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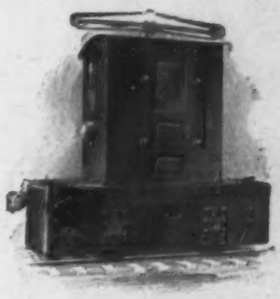

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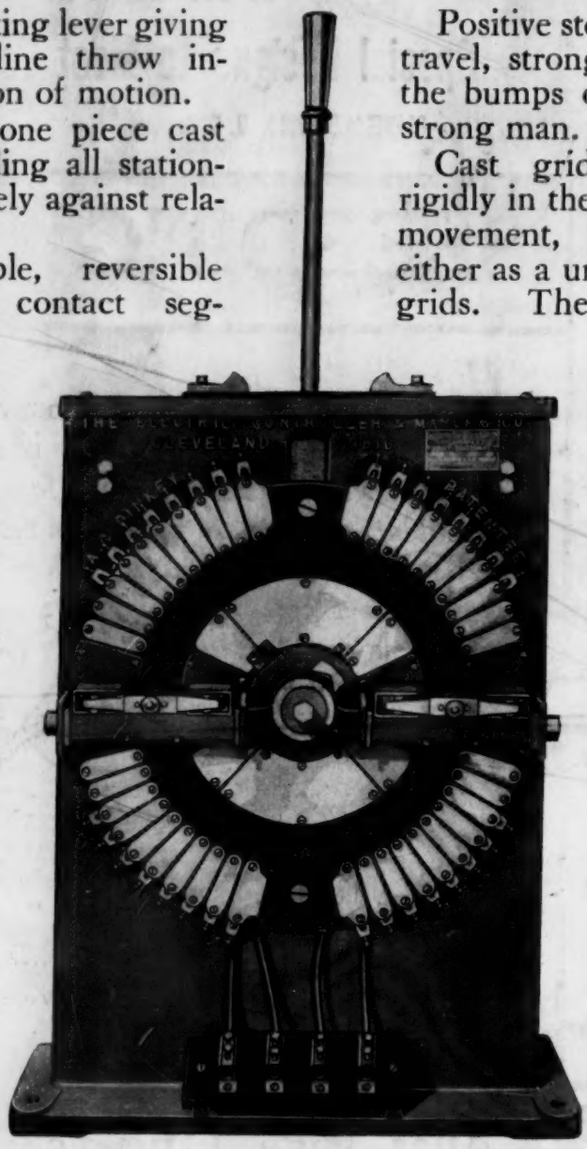

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